THURSDAY, JANUARY 6, 1876

LASLETT'S "TIMBER AND TIMBER TREES"

Timber and Timber Trees, Native and Foreign. By Thomas Laslett, Timber Inspector to the Admiralty. Crown 8vo, pp. 352. (London: Macmillan and Co. 1875.)

IN all parts of the world where the vegetation partakes of an arboreous character, the wood is applied by the natives either for building their huts or houses, for their canoes or war-vessels, or for various domestic purposes, according to the extent of civilisation under which they live. This universal application of timber dates back to the earliest ages, and though the world's consumption of wood has been increasing ever since, and more especially in modern times, the supplies have never yet absolutely failed. Though the trade in timber, properly so called, that is for building purposes as distinguished from ornamental woods, is one of immense proportions and great value, the more general application of iron at the present day for constructive purposes has to some extent, no doubt, prevented a dearth in the timber market. Notwithstanding this substitution of iron both in shipbuilding and in general mechanical work, no absolute diminution in the quantities of timber imported into this country has been effected. On the contrary, the official returns show a gradual increase both in rough and in planed or *dressed* timber, large quantities of which now come regularly from Sweden and Norway, from Russia, British North America, and other countries.

There are but few, if any, of our commercial articles, whether they be of home or foreign produce, that have a wider range of interest or more numerous ramifications than the wood and timber supplies. Primarily the subject may be divided into two divisions, the first dealing with timber as used for constructive purposes, and the second with woods as used by the cabinetmaker or for ornamental work; and still another important division is that of dye woods.

When we consider that the value of timber chiefly for building purposes imported into this country during the year 1874 amounted to over twenty millions sterling, it is surprising that so little is generally known or so few books have been written on a subject of such great commercial and general importance. Besides the produce of our own forests, composed for the most part of oak, larch, fir, ash, beech, &c., the bulk of the wood imported from Sweden, Norway, Russia, &c., is the produce of coniferous trees, the botanical origin of which are for the most part known; but over and above these are numerous woods which, though they are and have been articles of commerce for many years past, are still quite unknown as to their botanical sources. And it is not a little remarkable that most of these unknown woods are the produce of some part of the South American continent. From Brazil and Paraguay, for instance, we are constantly receiving samples of finely-marked hard and apparently durable woods, but no information ever reaches us of the nature of the trees furnishing these woods. If collectors would only bear in mind that samples of wood with native names only are next to valueless, and would use every endeavour to secure and bring home a flowering specimen of the tree producing any particular wood, they would be helping to develop the resources of the forests, besides contributing to the knowledge of the flora of the country. But this is a matter which does not concern the importer so long as the necessary supplies are forthcoming and remunerative prices can be realised; and it is by the agents or exporters alone at the port of shipment that this information can be obtained, consequently our knowledge of the sources of the ornamental hard woods of commerce remains pretty much as it did ten or even twenty years ago. It is true that at the several International Exhibitions, notably those of 1851 and 1862, some remarkably fine collections of woods were exhibited, but only in comparatively few cases were really trustworthy catalogues prepared. Even the British Guiana collections, which were remarkable for the size of the specimens and the care exercised in their selection, were wofully deficient in scientific nomenclature, and remain so to the present time, simply on account of the absence of flowering specimens, which should have been collected at the time of cutting the timber.

It is no doubt in consequence of these obstacles and the scant material at command that no one has hitherto been tempted to take up our timber and wood supplies as a special subject. Many are the collections that have been formed of British and foreign woods, but they have never found a champion in the same way that drugs did in the late Daniel Hanbury, who grudged neither time, trouble, nor expense in seeking authentic information in his favourite pursuit. The most complete lists of woods perhaps ever published are those contained in the Jury Reports of the Great Exhibition of 1851, where, besides notes on the qualities of the woods and their uses, their weights per cubic foot and their specific gravities are in some cases given. In 1852 a useful "Descriptive Catalogue of the Woods commonly employed in this country for the Mechanical and Ornamental Arts" was published by Charles Holtzapffel, but this book is of course now out of date, and nothing of any importance has since appeared beyond a few occasional lists and papers scattered about in different journals.

It was therefore with some satisfaction that we took up the book whose title stands at the head of this notice, with the hope that we should find it a trustworthy handbook of woods in general. It required, however, but a slight glance to show us that it was devoted almost exclusively to the consideration of timber for building or carpentry work, to the exclusion of ornamental woods. This we regret the more as the timber and hard wood trades, though distinct in themselves, are nevertheless closely allied subjects, and treated together with proper care and attention, would form a most valuable work.

Taking the book as it is, we find that a large portion of the early part is devoted to the question of the formation and structure of wood, matters which we think unnecessary in a work of this description, occupying space which might be much more advantageously used. A chapter is also given on the computation of the ages of trees and their rate of growth. After referring to the computed ages of well-known large trees, by which it has been estimated amongst others that the oak attains to an age of

810 to 1,500 years, the yew from 1,214 to 2,820, and the Baobab (*Adansonia digitata*) to 5,000 years, the author points out that these figures have been based upon the general assumption of each concentric ring of wood being the growth of one year. Speaking of his own experience, he says:—"I have carefully examined and counted the annual layers of a great many specimens—taking generally the average of the trees—with the view to show the common and comparative rates of growth, and have tabulated them to afford an opportunity of noticing any variations there may have been in the time required to form the wood in each of the several given diameters of 6, 12, 18 inches," &c. In these tables it is shown that in fifteen specimens of oak, the diameter of whose stems were in all cases 6 inches, the number of rings ranged from 12 to 49; in the same number of sections measuring 12 inches diameter they ranged from 19 to 105, and in those of 18 inches diameter from 24 to 160. In sections of Greenheart (*Nectandra Rodiæi*) of 6, 12, and 18 inches diameter, the concentric rings were respectively 37, 60, and 83, while in Mexican mahogany of the same dimensions the result showed the number of rings at 17, 30, and 44. In most cases from six to ten sections were examined, and the average so obtained.

In the matter of ordinary timber the information given is varied and tolerably complete, and the opinions of the author as regards strength, durability, and value for practical purposes may, of course, be taken as the opinion of one having experience and authority to speak on such matters. Moreover, the tables showing the breaking weights of the different woods and their specific gravities are the results of actual experiments. It is much to be regretted that in a work of this kind, which has not been produced without some care, more attention has not been given to scientific accuracy, not only in tracing out the sources of the woods mentioned, but also in bringing what botanical nomenclature has been attempted down to modern times. Thus, for instance, the "Maçaran duba" of Brazil (p. 182) might have been accredited as being a species of *Mimusops*, the "Cedro," on the following page, not as a species of "Cedar" but of *Cedrela* (*Cedrela odorata* probably), and the "Vinhatico," (p. 186) probably *Persea indica*. Again, with regard to African oak or teak, it is stated to be "probably the *Swietenia senegalensis* or *S. Khaya*," but it is well known that the durable timber commonly known under the above names is produced by *Oldfieldia africana*, a Euphorbiaceous tree. The Cuban Sabicu wood, likewise, of which the stairs of the great Exhibition building in Hyde Park in 1851 were constructed, and which, we believe, are still in use at Sydenham—such is the durability of the wood—is described as being produced by *Acacia formosa*, but it is under *Lysiloma sabicu* that any description of this wood is to be found in works of a botanical character.

It is not with the view of depreciating the value of the book that we point out these errors. In a new edition, with the aid of a botanist and a determination to extend the scope of the work so as to include all woods known in commerce, the value of the book might be considerably enhanced. As it is, however, besides the technical details there are numerous interesting facts distributed through its pages, many of which are new to us.

JOHN R. JACKSON

*RECENT FRENCH EXPERIMENTAL PHYSIOLOGY**

Physiologie Expérimentale. Travaux du Laboratoire de M. Marey. (Paris: G. Masson, 1876.)

THE second of the memoirs in the work before us, by M. Marey, contains the description of a new *schema*, or dynamical model of the circulatory system, which from the ingenuity of its construction calls for special notice.

M. Marey, not satisfied with the original attempt of Weber to reproduce the phenomena of the circulation in a system of elastic tubes, nor with his own earlier efforts in the same direction, was led to the construction of the one to be noticed immediately. He tells us that all previous models were correct enough in imitating certain special points in the vascular circulation, but these were at the expense of, and to the total neglect of, others. The perfect reproduction of each phase is the end he has had in view in the construction of the new apparatus.

It can be proved without doubt that the heart takes a longer time to relax than to contract; the systolic curve, when represented graphically, is therefore more abrupt than the diastolic. To represent this on paper mechanically, the easiest method is by the employment of a cam or eccentric, which, as it turns, lifts a lever resting upon it and following the variation in its eccentricity.

In Fig. 1 the winch handle turns an axle on which two cams are fixed, the whole being connected with the two steady-arms and the immovable upright board on the left-hand side. A flywheel tends to render the rotation of the axle uniform. The irregularly-shaped eccentrics (C.V. and C.O.), the form of which will be explained further on, each move one of the smaller boards to the right of the figure, because these are pressed towards the left by the elastic spring F, and the dilatation of the cavities of the artificial heart (V and O), whilst they are being refilled. They transmit their movements through the intervention of the fixed pulleys attached to the boards, which latter again act on the artificial heart by the strain they exercise upon the cords S.O. and S.V. The action of the auricle being intermittent, the machine is so arranged that the cord S.O. is lax (as in the figure) during the time that it is at perfect rest. The ventricle never being in a state of true repose, but always in a state of contraction or expansion, it does not require the extra apparatus.

The artificial heart is constructed with caoutchouc cavities, supplied with valves to represent those in the human circulation. The *auricle* is covered with netting, to which four parallel cords, running through holes in the big board, are attached. The cords are fixed on a square piece of wood, which is kept in position by a spiral spring, and in connection with the moving board by the thread S.O. The *ventricle* has over it a case (white in the figure) to the edges of which cords are fixed, which are attached at their other ends to a board, which is put into communication with the moving board by means of the hooks and elastic rings (F), and the cord S.V. It is evident that any strain on the cords S.V. or S.O. will compress the auricle (O) and the ventricle (V) against the main board to which they are attached, and so produce a systole of

* Continued from p. 146.

these viscera. A magnified view of this artificial heart, into the cavities of which recording "ampoules" have been introduced, is given in Fig. 2.

As to the construction of the cams, M. Marey draws a curve to represent the systole and diastole of the ventricle of the actual heart, figuring it as a simple rise followed by a less abrupt fall. He divides the linear horizontal projection of this by twenty equidistant points, from which he projects the same number of parallel vertical lines, or ordinates. Taking a small board he draws on it a circle, from the centre of which radiate twenty equidistant lines, of which, when one has been measured off so as to equal in length the first ordinate of the cardiac horizontal curve, the others are made to correspond with the second, third, &c. On uniting by a line the extremities of these rays, a closed curve is the result, which must form the edge of the cam C.V. The cam C.O. is constructed in a similar manner from the auricular trace.

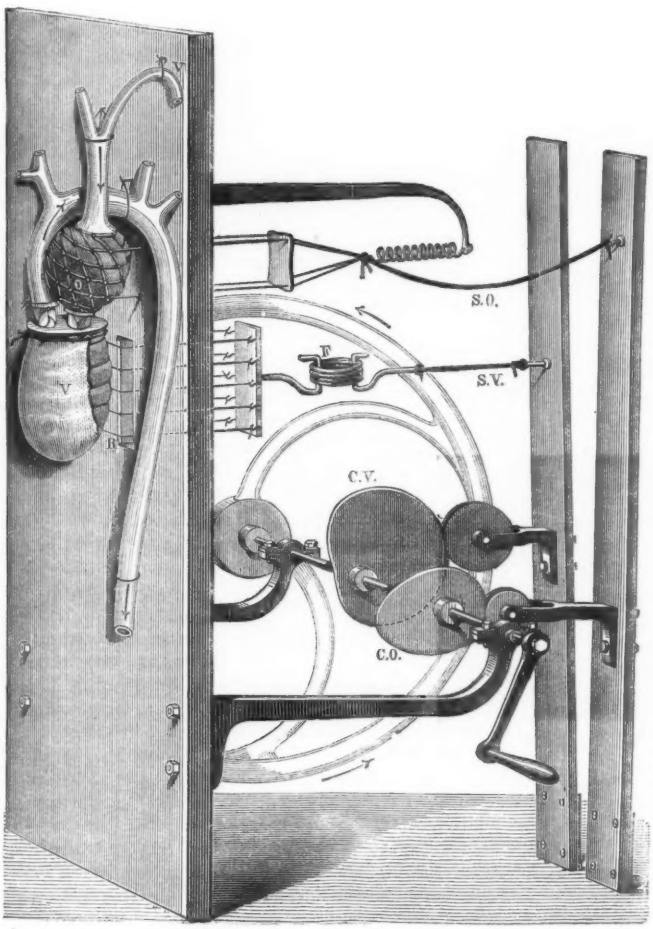

FIG. 1.

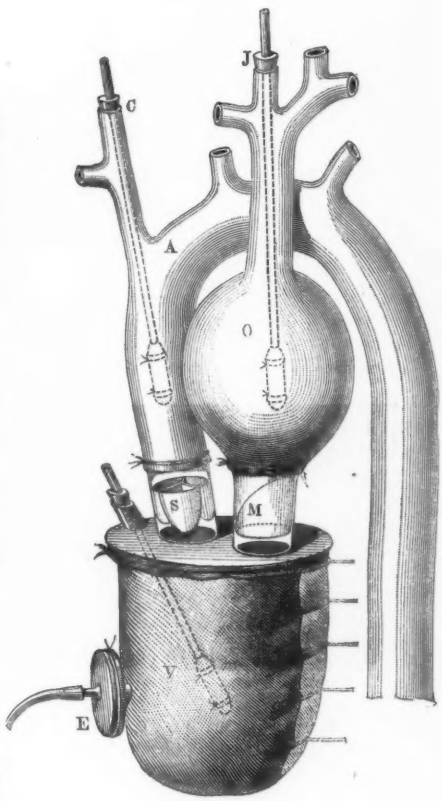

FIG. 2.

When the cams are placed on the axle of the machine in such a position that its rotation in one direction at a certain speed produces a compression (or systolic movement) by the auricular one at the interval of time before that of the ventricular which elapses between the systoles of the living auricles and ventricles, then the actual cardiac revolution is correctly imitated both in this particular and in the relative duration of the systoles themselves.

To verify the accuracy of the arrangements in the above-described *schema*, traces have been taken from it similar to those from the auricles, ventricles, and arteries of the horse. Fig. 2 illustrates the actual position, in the artificial heart, in which the elastic ampoules (sacs filled with air) which transmit its movements to recording levers (Fig. 3) were placed; and Fig. 4 is a simultaneous tracing from the four, the fourth being that of the motion of the heart-wall at E. The top curve is that from the auricle; the next is from the ventricle; and the third from the aorta.

In Figs. 1 and 2 the proximal vessels alone are represented to save confusion.

M. Marey claims for this his new *schema* that with it he can reproduce all the phenomena of the cardiac circulation; at the same time that with it he can master all the theories with reference to the significance of the most

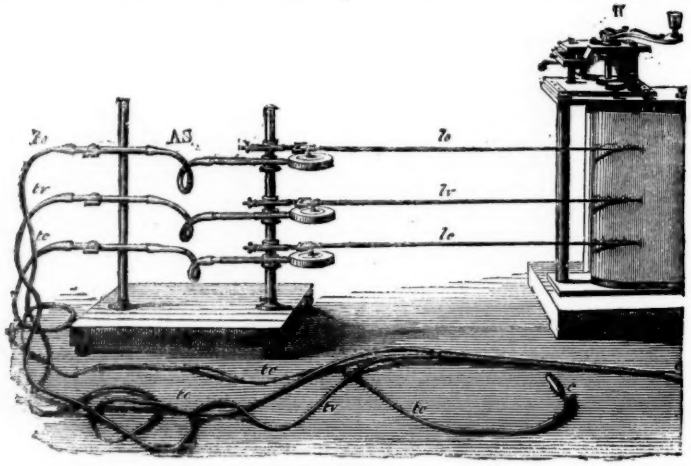

FIG. 3.

important elements of the pulsation of the heart. In this we think he is too sanguine; for there are fundamental elements of the cardiac circulation which it is quite unable to indicate even the existence of by means of it. One of

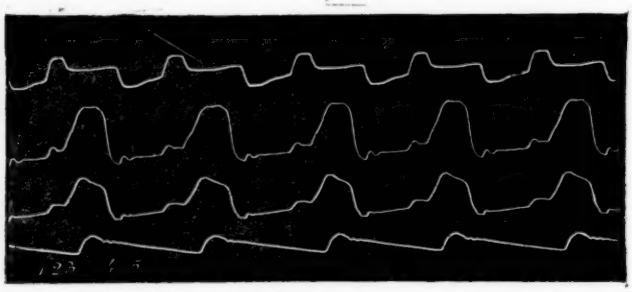

FIG. 4.

the most important of these is the fact that the relative length of the systole and diastole varies with the rapidity of the pulse, a most important point not at present sufficiently laid stress on. Another is the active diastole of the ventricle, which immediately follows the closure of the aortic valve. These and other minor considerations all go to prove that, though the new *schema* of the circulation is a great improvement upon all others yet introduced, nevertheless the exact representation of acts so complicated as the systole of muscular cavities cannot yet be imitated by the employment of the unaided mechanical powers.

DAMMANN'S RACE-PHOTOGRAPHS

Ethnological Photographic Gallery of the Various Races of Man. By C. and F. W. Dammann. (London: Trübner and Co.)

THE science of anthropology owes not a little to the art of photography. It is true that in previous times some few artists took the trouble to draw careful race-portraits. Catlin's American Indians (particularly the large copies) and Burchell's Hottentots and Bushmen, were among those of real value. But most engravings of race-types to be found in books were worthless, either wanting the special characters of the race, or absurdly caricaturing them. Now-a-days, little ethnological value is attached to any but photographic portraits, and the skill of the collector lies in choosing the right individuals as representatives of their nations. Thus the great *Anthropologisch-Ethnologisches Album* of Carl Dammann of Hamburg, completed some months go, is one of the most important contributions ever made to the science of man. Consisting of fifty plates, portfolio size, with ten to twenty photographs on each plate, it goes far toward an adequate representation of man in all his varieties. A copy may be seen at the Anthropological Institute, but its cumbrousness and cost (18*l.*) are beyond the limits of most private libraries. It is therefore satisfactory that the publishers have now brought out a smaller educational atlas, price 3*l.* 3*s.*, containing from 150 to 200 portraits, in a binding suitable for a drawing-room book. We wish it all success, for it will make new anthropologists wherever it goes.

The plan on which the portraits are arranged is mainly geographical, exact race-division being from the nature of the case impracticable. Indeed one of the effects of both the large and small albums will be in a negative direction. They will do more than any quantity of written criticism to check the rash generalisation as to race so common in ethnological systems, and they will do this by impressing on the minds of students the real intricate blending of mankind from variety to variety. It is not impossible that some day the time may come for scientifically calculating the constitution of a race, on Quetelet's principle of a central type with gradually decreasing variants. But that time has not come yet, and the most

that can at present be done to define a race-type is vaguely to make out some of its dominant features. A good example may here be seen in Plate I., which is headed "Germanic Types," though not consisting entirely of them. The last portrait is of a Welsh market girl, and just above her is Livingstone, who as we know was from the Gaelic Island of Ulva. If there is such a thing as a Keltic type, these two portraits show it; they might very well have been father and daughter. The contrast of the dark, near-eyed, compact-featured Welsh girl with the fair North German peasant woman next her is excellent, and the Bavarian lady next again shows the difference as well as possible between South and North German.

It is needless to enumerate the peoples of each district of the globe who have contributed their cartes-de-visite to this album, but a few remarks on incidental points occur as one turns over the plates. A young newly-married couple from China suggest an answer to the question, At what age may ethnological portraits best be taken? No doubt it should be somewhere about twenty years old, more or less, when the physical type has become developed, but the influence of thought, occupation, and circumstances have not yet masked the lines of race. In these plates, the elderly Chinese broker and the Japanese gentleman aged sixty-four, are in expression curiously like what Europeans of the same age and occupations might be. Yet when they were young, the faces of these Orientals probably bore no such apparent European likeness. What an ethnologist wants is not the cast of education and experience, but the mere national face, and this must be taken young. Again, for contrast between purity and mixture of nations, it is interesting to compare Plate XII., containing Siberian tribes of comparatively uniform type, with the heterogeneous figures in the next plate from Morocco and Algeria. The gradual blending of races, of which mention has been already made, may be well studied in Plates VIII. to XI., which bring into view better than it ever has been shown before, how the Malay peculiarities are to be traced into the Chinese and Japanese types. Lastly it may be remarked that the often-repeated ethnological theory deriving the natives of America from Eastern Asia, will receive but little support from a comparison of the portraits here given from Siberia, Japan, and China on the one hand, and North America on the other.

By way of fault-finding, it may be added that the short letterpress at the foot of the plates wants revision.

EDWARD B. TYLOR

OUR BOOK SHELF

The Eastern Seas: being a Narrative of the Voyage of H.M.S. "Dwarf" in China, Japan, and Formosa. With a Description of the Coast of Russian Tartary and Eastern Siberia, from the Corea to the River Amur. By Capt. B. W. Bax, R.N. With map and illustrations. (London: John Murray, 1875.)

CAPT. BAX spent three years, 1871-4, cruising about in the waters on the east of Asia, and has written a pleasant gossipy account of what he saw. He went over ground that has been often traversed, and has not much that is new to tell. Many details, especially historical, are confessedly borrowed from well-known authorities, so that the work is to some extent a compilation. An unnecessarily large amount of space is devoted to accounts of various wrecks that occurred on the coasts near where the *Dwarf* happened to be cruising, and many incidents of trifling importance are narrated, adding considerably to the size but not to the value of the book. Probably the most valuable part of the work is that wherein the author's visits to Formosa and to the Russian coasts are described. Capt. Bax had some favourable opportunities of becoming acquainted with the Formosans, both civilised and wild, and gives some interesting details as to their appearance, manner of life, and customs; his second chapter is a history of the island from its discovery by the Chinese. There is a good map of the island, and it would have added to the value of the work had there been a map of the whole region with which the book is concerned. In his narrative of the voyage of the *Dwarf* along the coast of Asiatic Russia, some interesting facts are given as to the present condition of the Russian possessions in that quarter as far north as Nikolevsk. Capt. Bax also made an ascent of Fusiyama, in Japan, of which he gives a pleasant account. Altogether, although the work adds very little to our knowledge of either China, Japan, or Asiatic Russia, it contains a good deal of interesting reading.

Commodore J. G. Goodenough. A Brief Memoir. By Clements R. Markham, C.B. (London and Portsmouth: Griffin and Co.)

THIS is a modest and well-written narrative of the life of a man whose premature death is a distinct loss to the British navy and to geographical science. Every naval officer should read it, and indeed all who wish to be inspired by the record of a noble life. The unfortunate circumstances connected with the death of Goodenough must be fresh in the memory of our readers. He undoubtedly was a martyr to what he conceived to be his duty; he fell in the attempt to conciliate the savages of Santa Cruz Island, and to assure them of the good intentions of England towards them. Had he been spared he would no doubt have done much good in this direction, as well as added to our knowledge of the Pacific Islands. Commodore Goodenough had high ideas of the scientific and other qualifications which are necessary to make an efficient naval officer, and took every opportunity to advocate these ideas. He himself was a man of varied attainments, and was a student up to the last. He took a warm interest in geographical science, and was for long an earnest advocate for a new Arctic expedition. Commander Markham and several other officers on board the *Alert* and *Discovery* had the advantage of serving under Goodenough; while Mr. C. R. Markham was himself his shipmate at an early part of his career. A good portrait is prefixed to the narrative.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Sir Thomas Millington and the Sexuality of Plants

I THOUGHT it was sufficiently obvious that Sir Thomas Millington's claims to be regarded as the discoverer of the function of the stamens in what are called hermaphrodite flowers was based upon what is stated by Grew. That I confess has always appeared to me conclusive upon the matter. I am not aware that Sir Thomas Millington ever published anything in his own name upon the subject.

With regard to Grew's book, I think Mr. Bennett is still under some misapprehension, which I trust he will allow me to point out to him. In NATURE (vol. xiii. p. 86) he speaks of a first edition of 1671, and also of an edition of 1681. In NATURE (vol. xiii. p. 166), he appears to identify the first of these with Grew's Treatise, "The Anatomy of Vegetables Begun, with a general account of vegetation founded thereupon," published in

1672. In 1682, he says that Grew published an enlarged edition of this smaller work under the *same* title. But this is not really the state of the case. The title of the large book is "The Anatomy of Plants, with an Idea of a Philosophical History of Plants." The volume has Sir Christopher Wren's *imprimatur*, which runs as follows :—

"At a meeting of the Royal Society, Feb. 22, 168$\frac{1}{2}$, Dr. Grew having read several *Lectures* of the *Anatomy* of *Plants*, some whereof have been already printed at divers times, and some are not printed; with several other *Lectures* of their *Colours*, *Odours*, *Tasts*; as also of the *Solution* of *Salts* in *Water*; and of *Mixture*; all of them to the satisfaction of the said *Society*: It is therefore Ordered, That He be desired, to cause them to printed (*sic*) together in one Volume.

"CHR. WREN, P.R.S."

The "Anatomy of Plants Begun" is simply reprinted in this volume. "The Anatomy of Leaves, Flowers, Fruits, and Seeds" is, however, printed for the first time. In the second part of this, called "The Anatomy of Flowers prosecuted with the bare eye and with the microscope," which was read before the Royal Society, Nov. 9, 1676, is contained Grew's discussion of the function of the parts of the flower in which the statement about Millington occurs..

Grew's "Anatomy of Plants" can no more be described as a second edition of the "Anatomy of Plants Begun" than Prof. Huxley's "Lay Sermons" can *collectively* be described as a second edition of any *one* essay republished in that volume.

The object of the quotation from Sprengel was to show what was his opinion of the claims of Camerarius to be considered the discoverer of sexuality in plants. As Mr. Bennett (vol. xiii. p. 166) makes a point of nothing being cited from Sprengel as regards Millington; here is what Sprengel says on that head. Speaking of Grew :—

"Summam vero meruit et seræ posteritatis gratitudinem, quod primus sexuum differentiam in partibus vel fœcundantibus vel fœcundandis *non invenerit, sed tamen defenderit* ac evulgaverit. Ipse verecunde satis et candide Thomam Millingtonium, Savilianum professorem Oxonii nominat, qui sibi dixerit, apparatum eum seminiformem (the anthers) vices partium masculorum probabiliter gerere" ("Hist. rei Herb.," ii. 14).

Next as to Camerarius and Ray, Mr. Bennett says that the observations of the first antedated those of the second by two years. On Mr. Bennett's own showing the date of Camerarius's tract is 1694 (NATURE, vol. xiii. p. 86). The date of the first volume of Ray's "Historia," in which he alludes to the subject, is 1686.

As to Theophrastus it is well known that classical writers on natural history were aware that the unisexual flowers of the date required the "pulvis maris," or pollen, to enable them to set their fruit. But I am not aware that till the time of Grew and Millington the fact that the vast majority of plants contain stamens and ovaries, *i.e.*, both male and female organs, had ever been ascertained. What these persons did for the first time was to point out the function of the essential organs of the flower.

Mr. Bennett, instead of taking his facts secondhand from Prof. Sachs's no doubt excellent "Geschichte," ought to have looked into the authorities himself. He would then avoid the error of quoting non-existent editions and of drawing conclusions which would be inexpugnable if they were not based on erroneous dates.

A. B. C.

Article "Birds" in "Encyclopædia Britannica"

IN that portion of the article "Birds," which I have lately written for the "Encyclopædia Britannica," I said (page 729, column 2) that *Odontopteryx* had "jaws armed with true teeth," and in this respect resembled *Ichthyornis*. The mistake has just been pointed out to me, and I shall be greatly obliged by being allowed to correct it, as far as is possible, in NATURE. The sentence should run thus: "jaws armed with tooth-like processes, and in this respect differing from Professor Marsh's *Ichthyornis*."

ALFRED NEWTON

Athenæum Club, Jan. 3

Fertilisation in the Basidiomycetes

IN your review of Dr. Pringsheim's "Jahrbücher" (NATURE, vol. xiii. p. 156) you refer to Dr. Max Reess' paper on the Fertilisation of the Basidiomycetes; this paper you compare with the results recently obtained by Van Tieghem, Dr. Eidam, and myself, and you say that the observations of the three former all tend in one direction, which fact should lead botanists to look with very great caution on my results, which are somewhat different.

As I am tolerably well acquainted with the three papers first mentioned, perhaps you will kindly allow me to point out that Dr. Reess' carpogonium, and the carpogonium of Dr. Eidam, are very different bodies, and that the latter author, in the "Botanische Zeitung," even puts a note of interrogation before his own interpretation of the body he figures as a possible carpogonium.

The spermatozoids as described and illustrated by me in the *Gardeners' Chronicle* for Oct. 16 and 23 last, are not essentially different from Dr. Eidam's spermatia; they agree in size, but I maintain that the threads which bear these male bodies come direct from the cystidia, and not from the basidia, and that they are at first spherical. In Dr. Eidam's excellent plate there are sixteen germinating spores shown which do *not produce spermatia*, and in each instance the spores are shown *as ruptured*. Three other spores are shown as *producing spermatia*; now these latter spores are engraved to twice the size of the former, and all three are *unruptured*. The explanation simply is that the latter threads have not come from the spores at all, but from a cystidium—the spores engraved have not germinated, and have merely been *washed against* the spermatia-bearing threads.

As for the species experimented upon abroad (except Van Tieghem's plant), one is rare, and the other not British; the plants I have been working upon are common everywhere.

In the January number of the *Popular Science Review* will be found an illustrated paper of mine on the "Reproduction of *Agaricus lacrymabundus*." In this essay will be found not only some new facts as to the reproduction process in the Basidiomycetes, but a *résumé* of the views now generally held on this subject.

WORTHINGTON G. SMITH

The Late Eclipse

I FIND in NATURE, vol. xiii. p. 86, a letter from Dr. Schuster, commenting on some remarks made by me last April respecting the photographic results of the late eclipse. He appears to consider that these remarks related to him personally, which certainly was not my intention. He speaks further of a mathematical solution promised by me, for which he has "had to wait already a considerable time." I remember nothing of such a promise, nor can I conceive how I could have promised, instead of giving at once, the solution of so simple a matter. Dr. Schuster proves very readily that the spectrum of the corona can be photographed in one minute; but I am not aware that anyone has questioned the fact. What I questioned myself was whether the spectral images of the corona can be so photographed that the true extension of the corresponding coronal envelopes can be shown. To quote my own words ("Science Byways," p. 168): "The whole light" [of the corona] "acting at once to form a photograph does not show *the full extension* of the corona, the outskirts simply losing themselves through excessive faintness. . . . How, then, can a minute portion of that light produce any photographic trace" [of the *outskirts*]? "How much less can this minute portion show *the whole extension* of the green solar envelope?" It was the hope that this might be effected which I described as mathematically unsound.

I am so busy that I cannot enter further into this matter. But in any case the only justification of controversy respecting it would be the hope that some purpose useful to science might be subserved. This seems unlikely.

RICHD. A. PROCTOR

New York, Dec. 16, 1875

Blowpipe Analysis

THANKING you sincerely for the very well written and not altogether uncandid (if rather severe) review of my lately published work on this subject (NATURE, vol. xiii. p. 164), against any part of which I would not at present presume to appeal, I would ask for a corner of your valuable space to explain, with regard to "the production of a precipitate" of sodium sulphide by the addition of a drop of water to a fused mass of soda with a sulphide on aluminium plate, that the term "precipitate" undoubtedly used by me (as the reviewer says so) is obviously a "slip of the pen," for there can be no room to *precipitate* anything in a drop of water from a fused mass on aluminium plate.

What I must have meant to say is, that the sodium sulphide appears like a precipitate, *i.e.* as a powder, in the partly dissolved mass. The reason of its appearing to be black on aluminium, and not, as it ought orthodoxically to be, brown, I cannot tell, as the metal is not attacked. Perhaps my reviewer can? I only say that it is so.

May I take this opportunity of soliciting you to afford, if possible, a little more space in your valuable journal, to the admittedly neglected subject (in England) of blowpipe analysis? It is, I can assure any of our chemists who have not much employed it, *a most fascinating* study, which will amply repay any leisure time expended upon it.

W. A. ROSS

Meteor in the Daytime

DEC. 22, about 2 P.M., as our servants were sitting at dinner by the kitchen window, two of them were startled by the sudden appearance of a brilliant meteor descending in the E. with a little inclination to the N. It was not as large as the moon, but much larger than Mars or Saturn, white, and like lightning, with a very quick course, leaving a train as broad as itself, and preserving its full size till it was lost behind the top of an oak tree at a little distance, whose branches, though leafless, seem to have concealed it from view. The next day I found by means of a compass and a joined ruler, that its azimuth was E. by N., its inclination towards N. about 10°, the upper window frame, where it probably came into sight, 48°, and the top of the tree 21° above the horizon. I have not, as yet, heard of any other observation of this remarkable meteor. The position of Hardwick Vicarage, where it was seen, according to the Ordnance Map, is Long. W. 3° 4′ 23″, Lat. N. 52° 5′ 20″.

T. W. WEBB

Protective Resemblance in the Sloths

AS "mimicry" and "protective resemblance" have chiefly been noticed among insects and the lowest of vertebrated animals, the following observation regarding the three-toed sloth, made at the beginning of this century, and therefore much in advance of the period at which attention had been directed to this subject, is, in these days, not without interest. It is taken from a work not frequently met with, namely, Baron Albert von Sack's "Narrative of a Voyage to Surinam" (London, 1810). In chap. xvi. at p. 170, he says:—"The colour and even the shape of the hair are much in appearance like withered moss, and serve to hide the animal in the trees, but particularly when it gets that orange-coloured spot between the shoulders, and lies close to the tree; it looks then exactly like a piece of branch where the rest has been broken off, by which the hunters are often deceived." The colour of the hair of the body is thus distributed in *Arctopithecus castaneiceps*, *A. griseus*, and *A. flaccidus* ("Notes on the Species of Bradypodidæ in the British Museum," by the late Dr. J. E. Gray. Proc. Zool. Soc., 1871, p. 428, Plates xxxv.–xxxvii.).

Brants, in his "Dissertatio Zoologica Inauguralis de Tardigradis" (Lugdun. Batav., 1828), p. 28, says of the sloths:—"At provida natura, cum animanti negaverit arma et tela, velleri cum colorem tribuit, quo subducatur oculis ferarum et adversariorum fere eadem ratione, ac Pallas retulit de *Pteromye volante*." The passage to which reference is made is in the "Novæ species quadrupedum e glirium ordine," p. 357:—"Dum vero in Betuletis præsertim vitam agunt, sapienter a natura perspectum est, ut omni tempore anni exalbido canescentem colorem velleris servent, quo cortici betularum ita fiunt similes, ut scandentes vix, imo sub diluculum, quo tempore præsertim excurrunt, plane non conspici eminus possint, coque ab avibus rapacibus nocturnis securiores sunt." Reference is also made to Prince Maximilian of Nieuwied's "Beiträge zur Naturgeschichte von Brasilien," tome ii. s. 480.

J. C. GALTON

Dec. 29, 1875

Coffee in Dominica

IN NATURE (vol. xiii. p. 38, and under the head of "Coffee in Dominica"), it is stated that the "falling off in the cultivation of the coffee plant, in a soil and climate which experience showed was eminently suited to it in every respect, was due to the extensive destruction of the plants by what was there known as the coffee blight." The foregoing statement requires this qualification, that after the appearance of the coffee blight, and when the coffee crop was gradually decreasing in quantity, the old coffee planters made no attempts to check the ravages of the destroying insect, but, in many instances, cut down the valuable trees, planted the sugar-cane, and converted their coffee-works into sugar-works. I could mention the names of several estates where what I have described was done. I think it right also to add that in some portions of Dominica, where the coffee-trees were simply abandoned, they now stand, and, considering their age and the neglect to which they have been exposed, they bear fairly well. During the last two years, and since the disastrous fall in the price of cane sugar, I have been endeavouring to reintroduce here the coffee cultivation, and, on the Tabery estate, 12,000 young trees of my own planting are doing well. You will confer a great and lasting benefit upon this beautiful but neglected and almost unknown island by calling attention to its capabilities as a coffee-producing country.

EDMUND WATT

South Chiltern, Dominica, Dec. 11, 1875

The Law of Storms

I HAVE to thank you for publishing, in NATURE of Dec. 2, 1875, my letter in reply to M. Faye's theory of cyclones, and I have now to submit some remarks on his theory of waterspouts.

I understand him to maintain that the dark part of the waterspout, which we see, contains a core of transparent air, which is descending at the centre of a vortex, and that the dark visible external part is a cloud formed by an ascending counter-current.

All this is unproved, and I think baseless. No dynamical reason can be assigned why there should be a downward current at the centre of the vortex. If the waterspout is formed in a vortex, which I think probable, though I am not certain of it, the vortical motion will produce not a downward but an upward current at its centre, in consequence of the diminution of barometric pressure, due to the air being thrown to the circumference by the centrifugal force. We see such upward currents formed in the little dust-whirlwinds that form themselves over streets and roads in windy weather.

Further, if M. Faye's theory were true, and if the waterspout were transparent at the centre, it could not be so well defined and solid as it usually is, nor could it be formed so rapidly.

The true theory of waterspouts is expounded in Espy's "Philosophy of Storms," a work which, notwithstanding its great error of denying the rotation of cyclones, made an era in meteorology, and, so far as I am aware, is not yet superseded.

When vapour is condensed into water, forming cloud, the latent heat of the vapour is liberated and expands the air. A simple calculation shows that, after deducting the destroyed volume of the condensed vapour, the increased volume of the air due to this expansion is between four and five times as great as the volume of the vapour before condensation. If, then, the air is nearly saturated with moisture, and the temperature in a state of convective equilibrium for dry air (that is to say, when the difference between the temperatures of any two strata is that due to the difference of their pressures), and condensation begins in any column of air, the effect of liberating this heat will be to make the air of that column warmer and lighter than the air at corresponding heights in the surrounding columns. What follows is from Espy's work, page 44:—

"It begins, by its diminished specific gravity, to rise, and then, if all circumstances are favourable, the cloud will increase as it ascends, and finally become of so great perpendicular depth, that by its less specific gravity the air below it, in consequence of diminished pressure, will so expand and cool by expansion, as to condense the vapour in it; and this process may go on so rapidly that the visible cone may appear to descend to the surface of the sea or earth from the place where it first appears, in about one or two seconds. The terms here employed must not be understood to mean that the cloud actually descends; it appears to the spectator to descend, but this is an optical deception, arising from new portions of invisible vapour constantly becoming condensed, while all the time the individual particles are in rapid motion upwards."

To this I will add as very probable, if not quite certain, that the rarefaction thus caused at the waterspout will produce an inflow of air from all sides, and this will produce a vortex at the centre; this again, by its centrifugal force, will increase the rarefaction, and thus will intensify the effect. But the commencement of the waterspout is in the way described by Espy in the above extract.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Dec. 12, 1875

The Glow-worm

ALTHOUGH in several Natural History Encyclopædias Scotland is excluded from the list of countries containing the glow-worm, I can aver that in Nithsdale and in the parish of Tynron, Dumfriesshire, they are quite plentiful. Yestreen, in Tynron, I observed one, to my surprise, shining by the wayside. It is a proof of the mildness of the season, no doubt, as I never saw them in December before, but have seen them several times as late as October.

When carrying one home one evening in my open hand it contracted itself and leaped out of my hand. This is a power they possess which I have seldom seen mentioned. The light in winter is much feebler than in summer, but the time was ten o'clock, or more than six hours after sunset that I saw it, whereas I never witnessed the glow of one in summer so long after dusk. Some that died with me forcibly reminded me of the poet's remark that between the rose's shadow and the very rose there was not a greater contrast than that between "the dead glow-worm and the worm that glows." J. SHAW

Tynron Schoolhouse, Dec. 26, 1875

OUR ASTRONOMICAL COLUMN

ENCKE'S COMET.—By the calculations of Encke and others who have continued them, we are in possession of the dates of perihelion passage of the comet which bears his name, from 1786 to 1875. If these be arranged and the intervals taken between the successive dates, it will be found that in the course of these ninety years the effect of perturbation has not changed the period of two successive revolutions by a hundredth part. The revolution 1819-1822 was 10·1 days longer than that between 1815 and 1819, and the revolution 1845-1848 was 11·1 days shorter than the preceding one, and these are the largest variations exhibited. In the same period, the longest interval between two successive arrivals at perihelion is 1215·6 days, 1842-1845, and the shortest 1200·2 days, 1868-1871.

In aphelion the distance of the comet from the orbit of the planet Jupiter by the elements of 1875 is 0·915, too great to allow of any violent perturbation. In about 123½° heliocentric longitude, and 6°·50′ north of the plane of the ecliptic the comet approaches the orbit of Mercury within 0·038; to bring the bodies into closest possible proximity it is necessary that the planet shall arrive at perihelion 12½ days before the comet, and we know that a very close approach to this condition took place in November 1848, whereby, on the 22nd of that month, the comet was brought within 0·0378 from the planet, a distance of about fifteen times that which separates the moon from the earth. A close encounter with Mercury appears hardly possible before the year 1904.

If the orbit of Encke's comet was fixed within its present comparatively restricted limits by planetary attraction, it seems quite as likely that this may have been occasioned by an extremely close approach to Mercury as that Jupiter at some distant period should have been the disturbing agent.

OCCULTATIONS OF THE PLANET SATURN.—We are not very fortunate in this country as regards the circumstances of the batch of eleven occultations of Saturn by the moon, which take place in successive lunations, commencing on the 22nd of March next; the only one visible in England being that on the morning of the 7th of August, and this will be a daylight phenomenon, the sun rising, at Greenwich, more than half an hour before the immersion. Of the ten occultations of the planet in 1870, three were visible here, and the occultations of that year possessed greater interest from the circumstance of the wider opening of the rings, than those of 1876 are likely to be attended with, wherever witnessed. The near approach of Saturn to the moon's limb between 1 and 2 A.M. on July 11, as viewed at Greenwich, does not appear to be converted into an occultation in any part of these islands.

While writing upon occultations, a word may be said of the close approach of the planet Jupiter to the star β^1 Scorpii, on the morning of February 28, which is entered as a possible occultation in the American Ephemeris. β Scorpii is a double star, the components being of 2 and 6½ magnitudes, distance about 13″, or according to the "Melbourne General Catalogue" of 1870, the smaller star follows in R.A. 0·40s., and is 11″·95 north of the brighter one. The apparent position of β^1 Scorpii on Feb. 27 is in R.A. 15h. 58m. 14·41s., and N.P.D. 109° 28′ 2·1″. The *Nautical Almanac* place of Jupiter, which is from Bouvard's Tables, will probably require a correction of about + 0·90s. in R.A., in which case the conjunction of planet and star would take place a few minutes after meridian passage at Greenwich on the morning of the 28th or about 5h. 40m. A.M., and the north limb of Jupiter is brought close upon the star, but there still seems likely to be a difference of some three or four seconds in N.P.D., by which small quantity the star may escape occultation. The companion is too far north to be occulted. This judgment is formed by a comparison of the latest published corrections of Bouvard, given by the Greenwich observations, and the differences between Le Verrier and Bouvard at the end of 1877.

A close approach of Jupiter to this star is recorded by the Chinese as early as the year A.D. 73; on the 12th of February the planet was very near the star, four days afterwards the star was seen having been previously hidden by the superior brightness of Jupiter; and the Chinese also report that the planet which had been very near to β Scorpii A.D. 512, January 12, occulted it on the 17th of April following.

PROF. STOKES ON THE EARLY HISTORY OF SPECTRUM ANALYSIS

THE following extract from a letter, relating to the early history of spectrum analysis, from our highest English authority on physical optics, cannot fail to interest, apart from its intrinsic importance, a wide circle of readers. I have therefore obtained permission from Prof. Stokes to forward it to NATURE.

C. T. L. WHITMELL

"CAMBRIDGE, *Dec.* 23, 1875

. . . . "I felt that the coincidence between the dark D of the solar spectrum and the bright D of a spirit-lamp with salted wick could not be a matter of chance; and knowing as I did that the latter was specially produced by salts of soda, and believing as I did that even when such were not ostensibly present, they were present in a trace (thus alcohol burnt on a watch-glass and a candle snuffed close, so that the wick does not project into the incandescent envelope, do not show bright D), I concluded in my own mind that dark D was due to absorption by sodium in some shape. In what shape? I knew that such narrow absorption-bands were only observed in vapours; I knew that as a rule vapours agree in a general way with their liquids or solutions as to absorption, save that in lieu of the capricious absorption of the vapour, we have a general absorption attacking those regions of the spectrum in which the vapour-bands are chiefly found. Hence as the sodium *compounds*, chloride, oxide, &c., are transparent, I concluded that the absorbing vapour was that of sodium itself. Knowing the powerful affinities of sodium, I did not dream of its being present in a *free* state in the flame of a spirit-lamp; and so I supposed that the emitting body in the case of a spirit-lamp with salted wick was volatilised chloride of sodium, capable of vibrating in a specific time, or rather two specific and nearly equal periods, by virtue of its sodium constituent; but that to produce absorption the sodium must be free. I never thought of the extension of Prevost's law of exchanges from radiation as a whole to radiation of each particular refrangi-

bility by itself, afterwards made by B. Stewart; and so I failed to perceive that a soda flame which emits bright D must *on that very account* absorb light of the same refrangibility.

"When Foucault, whom I met at dinner at Dr. Neil Arnott's, when he came to receive the Copley Medal in 1855, told me of his discovery of the absorption and emission of D by a voltaic arc, I was greatly struck with it. But though I had pictured to my mind the possibility of emitting and absorbing light of the same refrangibility by the mechanism of a system of piano strings tuned to the same pitch, which would, if struck, give out a particular note, or would take it up from the air at the expense of the aërial vibrations, I did not think of the extension of Prevost's theory, afterwards discovered by Stewart, nor perceive that the emission of light of definite refrangibility *necessitated* (and not merely *permitted*) absorption of light of the same refrangibility.

"Reviewing my then thoughts by the light of our present knowledge, I see that my error lay in the erroneous chemical assumption that sodium could not be free in the flame of a spirit-lamp; I failed to perceive the extension of Prevost's theory, which would have come in conflict with that error.—Yours sincerely,

(Signed) "G. G. STOKES

"To Chas. Whitmell, Esq."

"P.S., Dec. 31.—As Sir Wm. Thomson has referred in print to a conversation I had long ago with him on the subject, I take the opportunity of describing my recollection of the matter.

"I mentioned to him the perfect coincidence of bright and dark D, and a part at least of the reasons I had for attributing the latter to the vapour of sodium, using I think the dynamical illustration of the piano strings. I mentioned also, on the authority of Sir David Brewster, another case of coincidence (as was then supposed, though it has since been shown to be only a casual near agreement) of a series of bright lines in an artificial source of light with dark lines in the solar spectrum, from which it appeared to follow that potassium was present in the sun's atmosphere. On hearing this Thomson said something to this effect: 'Oh then, the way to find what substances are present in the sun and stars is to find what substances give bright lines coincident with the dark lines of those bodies.' I thought he was generalising too fast; for though *some* dark lines might thus be accounted for, I was disposed to think that the greater part of the non-terrestrial lines of the solar spectrum were due to the vapours of *compound* bodies existing in the higher and comparatively cool regions of the sun's atmosphere, and having (as we know is the case with peroxide of nitrogen and other coloured gases) the power of selective absorption changing rapidly and apparently capriciously with the refrangibility of the light.

"If (as I take for granted) Sir William Thomson is right as to the date [1852] when he began to introduce the subject into his lectures at Glasgow (Address at the Edinburgh Meeting of the British Association [1871], page xcv.), he must be mistaken as to the time when I talked with him about Foucault's discovery, for I feel sure I did not know it till 1855. Besides, when I heard it from Foucault's mouth, it fell in completely with my previous thoughts.

"I have never attempted to claim for myself any part of Kirchhoff's admirable discovery, and cannot help thinking that some of my friends have been over zealous in my cause. As, however, my name has frequently appeared in print in connection with it, I have been induced to put on paper a statement of the views I entertained and talked about, though without publishing.

"In ascribing to Stewart the discovery of the extension of Prevost's law of exchanges, I do not forget that it was re-discovered by Kirchhoff, who, indeed, was the first to *publish* it in relation to light, though the transition from radiant heat to light is so obvious that it could hardly fail to have been made, as in fact it was made, by Stewart himself (see 'Proceedings of the Royal Society,' vol. x. p. 385). Nor do I forget that it is to Kirchhoff that we owe the admirable application of this extended law to the lines of the solar spectrum."

*SCIENCE IN THE ARGENTINE REPUBLIC**

THE fourth part of the Bulletin of the National Academy of Sciences recently founded at Cordova, in the Argentine Republic, completes the first volume of this remarkable work, of which we have previously given some account to our readers.† The present part is mainly occupied by the conclusion of a long article upon the vegetation of the little known province of Tucuman, in the interior of the Republic, by Dr. Hieronymus, commenced in a former number. This is based upon the observations made by the author during a long and extensive scientific journey in that province, and upon the collections amassed by Dr. Lorentz in the same districts in 1871 and 1872, which have been mainly determined by Prof. Grisebach, of Göttingen. A second important article is by Dr. D. A. Döring, and treats of the land and freshwater Molluscs of the Argentine Republic, amongst which are a considerable number of new species, and several interesting novel forms discovered by the author. A third memoir, from the pen of Dr. Burmeister, treats of the abnormal Hymenopterous insects of the Linnean genus *Mutilla*, and forms a complete monograph of the native species of this group, which will be very acceptable to entomologists. By the chronicle appended to the number, we learn that the strife which has prevailed between the Director of the Academy and the six German professors originally imported for its constitution has terminated in the signal defeat of the latter. After the expulsion of about half the number, the remainder resigned, and their places have been filled by other professors from the same country, whom we trust Dr. Burmeister will find more tractable. That they are full of work is evident by the contributions to science already published in the present volume, upon the successful completion of which we heartily congratulate the energetic and illustrious Director of the Academy of Natural Sciences of the Argentine Republic.

SOME UNSOLVED PROBLEMS IN THE MANAGEMENT OF THE MARINE AQUARIUM

IT would be fatal to further progress in that direction in which so much has been achieved during the last ten years, if the zoological conditions of even the most successful of existing marine aquaria were to be blindly accepted as incapable of improvement, and especially if further experiment in reference to the vexed question of aëration were to be barred by the assumption that any one of those rival systems which are typified in the practice of Brighton, Sydenham, or any other similar establishment, is necessarily the best which can be attained.

More discussion than it has yet received is due to the broad question whether the total or almost total exclusion of vegetation from public aquaria is based on necessity or philosophy; whether artificial may not be advantageously supplemented by this most natural and automatic mode of aëration; and the further question remains, to what extent must the conditions of the aquarium be modified, as regards circulation and introduction of air, in order to render practicable the establishment and maintenance of a healthy vegetation, if the propriety of its introduction

* "Boletin de la Academia Nacional de Ciencias exactas existente en la Universidad de Cordova." Entrega iv. (Buenos Ayres, 1875.)

† See NATURE, vol. xi. p. 253.

be once conceded as a result of theoretical considerations?

Before briefly discussing these questions, let us refer for a moment to one or two other minor points which deserve a passing consideration as bearing upon the state of the marine aquarium as a miniature sea, the health of whose inhabitants is ensured in proportion as its actual conditions approach to those of its natural prototype.

It has been suggested that the proportion of carbonic acid held in solution in the water is a matter of more importance than has been recognised, and that the effect of the constant influx of a copious and finely comminuted stream of air passing night and day through the tanks is, after pretty completely oxidising the organic matter with which their contents are charged, to displace the resulting carbonic acid, and so reduce its percentage below the normal amount present in the ocean; and a parallel has been drawn between the condition of the inhabitants under these circumstances and that of human beings breathing an atmosphere containing an abnormal proportion of oxygen.

In confirmation of this opinion, it has been pointed out that one of the prominent results of the *Challenger* researches is that animal life is abundant at the bottom of the sea, while the amount of carbonic acid held in solution in its lowest strata exceeds that of the surface layer by six or seven per cent.

Now, it is certain that, supposing all sources of further or continuous supply of carbonic acid to be excluded, the exposure to the air of any given bulk of water containing the maximum quantity of that gas which it is capable of holding in solution (or any less quantity) will finally result in its total elimination; for Dalton long ago established laws from which it follows that when water saturated with a gas, *e.g.* carbonic acid, is placed in contact with the open air, the whole of such gas is set free, while the water absorbs the constituents of the air.

Hence the small quantity of carbonic acid always present in sea-water is not due to absorption from the air, but to the incessantly renewed supply afforded by the oxidation of organic matter in the sea itself.

If this supply were not constantly maintained, this constituent would vanish from the ocean. Its higher percentage in the lower strata of the sea is doubtless due to three causes: 1, to the comparative stillness of the water, whereby the diffusion of the solution is retarded; 2, to the absence of direct contact with the air and exposure to the wind; 3, and chiefly, to the increased pressure, whereby solution of the gas is greatly facilitated; for under pressure of 1 atmosphere and at ordinary temperatures, 1 cubic centimetre of water dissolves in round numbers 1 cubic centimetre, or 1·529 milligrammes, of carbonic acid, while under double that pressure the absorption is double, and so forth, varying directly as the pressure, *approximately*.

It can hardly be doubted that this presence of a larger proportion of carbonic acid in the lowest depths of the ocean has a distinct correlation to the character of their special inhabitants.

Prof. Wyville Thomson writes: "In the 'warm area,' and wherever the bottom is covered with ooze, calcareous forms predominate, and large sandy cristellarians, with their sand-grains bound together by calcareous cement, so that the sand-grains show out, dark and conspicuous, scattered on the surface of the white shell." And again: "The dredging at 2,435 fathoms at the mouth of the Bay of Biscay gave a very fair idea of the condition of the bottom of the sea over an enormous area. . . . The surface layer was found to consist chiefly of entire shells of Globigerina bulloides, large and small, and fragments of such shells mixed with a quantity of amorphous calcareous matter in fine particles;" and he proceeds to trace how the gradual subsidence of this ooze is forming, under the pressure of superincumbent water, vast geological strata, just as they have been formed for countless ages in the past.

Now, carbonate of lime is much more freely soluble in water containing carbonic acid than in pure water. Hence the abundant supply of this substance in the bed of the ocean is doubtless freely taken up into solution, to be in turn abstracted and secreted by fresh generations of living animals; and thus the carbonic acid forms, as it were, a carrier or circulating medium, if not essential to, at any rate vastly facilitating the ever-alternating processes of life and death, by which the surface of the submarine globe is being constantly and profoundly modified.

But, on the other hand, the animals kept in aquaria are essentially surface-dwellers; the tubicolous Annelids, Actiniadæ, Echinoderms, Crustacea, Nudibranchs, Mollusca, and fishes, which can be successfully kept in confinement all belong to this category, and are captured either between tide-marks or within a few fathoms of the surface. Coral-building Anthozoa perish as the subsidence of the areas in which they dwell plunges them into depths exceeding fifteen or twenty fathoms, a fact which is the basis of Mr. Darwin's simple and elegant theory of the formation of circular reefs and "atolls."

It appears that the amount of carbonic acid present in the tanks of a marine aquarium must represent the balance between the quantity evolved from decaying animal matter, exuviæ, excreta, remnants of food, and the like, and that eliminated from the water by the absorption of air. It has probably never been determined, and its accurate estimation would be a problem both easy and interesting.

But in comparing or contrasting the conditions under which animals live in the confinement of the tanks with those which prevail in the open sea, it must not be forgotten that there is present in an artificial collection of animals an element wholly different from those which exist in the ocean.

In the upper layers of the sea, at any rate, the bulk of water passing over any given animal is tens of thousands of times greater than if the whole contents of the largest aquarium were circulated over it daily. In comparison, the animals are far more sparsely distributed, and dead organisms, together with rejectamenta of all sorts, are swept away by the first tide, and practically got rid of once and for all, so far as their effect on the living individual is concerned.

In the aquarium, animals are disposed in groups artificially brought into comparatively close juxtaposition, and direct oxidation is the only means of removing the various organic impurities of which they are the source.

The observations of the *Challenger* naturalists show that the amount of organic matter in surface and bottom waters is about the same, being about 2½ times as great as in intermediate strata. It corresponds, therefore, to the more abundant distribution of animal life; yet no one can doubt that the percentage of organic matter present in the aquarium vastly exceeds that in the sea, owing to the non-dilution of decomposing animal matter by any such enormous influx of pure water as is supplied by the tides and currents of the ocean.

Hence there is an evident necessity for much more direct aëration in order to prevent the accumulation of organic matter either dissolved or suspended.

Pari passu with aëration, the formation of carbonic acid increases, but as this substance is in turn eliminated by excess of air, experiment alone can determine whether the amount present in the aquarium, as now worked, is greater or less than that contained in either the upper or lower strata of the ocean.

We may, at any rate, safely conclude that it is of the utmost importance to have command at all times of a superabundant *power* of aëration.

The possibility of increasing it to meet the emergency of some sudden temporary pollution arising from the death of some of the inhabitants, the careless introduction

of excess of food, or some other casualty coming into the category of possible accidents, may be invaluable. The influx of air can always be regulated, or even stopped, while an insufficient supply might be fatal, at least to the more delicate animals.

Let us now consider briefly the larger question, whether vegetation ought to be admitted at all, and if so, under what limitations and with what precautions.

It is a proposition requiring no proof that the more nearly the actual conditions of nature can be approached in our tanks, the more likely is success to ensue, and the more varied will be both the classes and species of animals which it will be possible to domesticate and maintain in health.

An aquarium without seaweeds does indeed seem a wide departure from this standard, and inasmuch as vegetation fulfils the double function of naturally aërating the water by absorbing carbonic acid and evolving oxygen, and of affording wholesome and palatable food to fishes and molluscs, its introduction would appear highly desirable if not attended with dangers more than sufficient to counterbalance its advantages. On this point my friend Mr. Hughes writes to me as follows in a recent letter:—"I can no more see how fishes and molluscs can do without vegetation than the higher primates without cabbages. I feel certain that the mortality of fishes is due to its absence in public aquaria. In my own tanks I have seen a Blenny tugging at a mere rag of Ulva, black almost with age, for half an hour, to get a mouthful of 'green meat.'

"Our most beautiful family of British fishes, the Wrasses, haunt the banks of Zostera and Fucus; and they do this for more than mere play!"

The lovely tribe of Nudibranchs is practically excluded at present by reason of the absence of their natural food, the one or two species now admitted being animal feeders, and by no means the most beautiful of their class.

Why, then, are not seaweeds seen in the aquaria at Brighton, Sydenham, or Paris?

I believe the answer to be this. For some reason they do not appear spontaneously in the tanks of public aquaria; possibly because the water is deprived of all germs of vegetation by the process of filtration or purification to which it is subjected before use; more probably because, in order to secure purity, it is generally taken from deep water, where such germs are likely to be absent.

Certain it is that in water taken from near shore and not filtered, vegetation very speedily makes its appearance; and it is impossible to suppose that the gentle flow of water in the aquarium could present any obstacle to the development of germs which are not prevented from finding a resting-place and reproducing their species in every rock-pool on shores washed by the tides and lashed by the storms of the open Atlantic.

As vegetation does not spring up spontaneously in the tanks, and as the possibility of doing without it has been practically demonstrated, its introduction has been avoided because the growth of Algæ is so rapid that they are apt to become uncontrollable, to overgrow and hide the animals from view, and at certain seasons by their rapid decay to introduce into the tanks a large amount of decomposing matter of the most objectionable kind—difficult to remove by oxidation, and likely to be fatal to many of their delicate inmates.

It cannot be doubted that the careless or indiscriminate admission of vegetation into the marine aquarium is open to all these objections; but, on the other hand, it seems probable that its careful and judicious introduction would be productive of excellent results to the health of the animals, while there cannot be two opinions as to its adding vastly to the charm of the whole scene. To clothe, or partly to clothe, the bare and monotonous grey and yellow surfaces of rock which now form the regulation background of our tanks with tufts of green and red seaweeds waving their delicate tresses in the gently-flowing water, would add the one thing now wanting to make the aquarium in practice what it is in theory, a miniature reproduction of rock-pools and sea-caves.

Now, the larger part of our British seaweeds are annual, and perish rapidly in autumn and winter, after producing countless zoospores from which a fresh generation of plants is to be born in due time.

These annual Algæ would be dangerous inmates of an aquarium, but in all three sections of the class (Rhodospermeæ, Melanospermeæ, and Chlorospermeæ) there are perennial as well as annual species, and in the first division the plants are usually of a more delicate nature than in the two latter, of slower growth, and therefore more manageable.

We should therefore choose from among the Chlorospermeæ the one or two species which alone are perennial or biennial, such as *Cladophora arcta* and *Codium tomentosum*.

Unfortunately all the other species of Cladophora are annual, as also are those of Enteromorpha and the lovely *Bryopsis plumosa*, which, however, might be tentatively admitted by reason of its small size, slow growth, and singular beauty.

Ulva latissima, *lactusa* and *linza* are also all annual, and should certainly be introduced very sparingly, if at all, and with precautions designed to control and curtail their growth, to which reference will presently be made.

Among the Melanosperms scarcely any would be available. It is among the Rhodosperms that the ornaments of the aquarium might be chiefly sought; and although experience would doubtless prove that some species of this charming group would not flourish in confinement, probably a sufficient number would be found, whose graceful forms and attractive colouring would add immensely to the beauty of the tanks, and which would yet be sufficiently slow in growth to be under the necessary control.

What could exceed in elegance the waving fronds of *Ptilota plumosa* or the plaited tresses of *Plocamium coccineum*?

What more delightful contrast could be imagined than that of the white and pink somewhat rigid tufts of *Corallina officinalis* mingling with the bronze-coloured leaves of *Chondrus crispus*?

What more charming juxtaposition than that of *Gelidium cornutum*, with its purple-black branches, the regularity of whose sub-division almost suggests a metallic crystallisation, with the crimson ribbons of *Delesseria sanguinea*, filmy almost to transparency?

Unfortunately the elegant Ceramiums are all annual, but among such species as *Rhodomela subfusca*, *Polyides rotundus*, *Polysiphonia fastigiata*, *Dasya coccinea*, and a score of others, all perennial and of moderate growth, there is an abundant choice of variety in form, habit, and colour, which would certainly justify the experiment of setting apart one or two tanks in some public aquarium for their trial.

Were such an experiment to be tried, it would be desirable to use every precaution first of all to ensure a clear field by the elimination, as far as possible, of all pre-existing germs of other species than those which it is proposed to cultivate; a precaution, however, the *necessity* of which the appearance of existing aquaria scarcely suggests.

Freshly gathered plants might then be introduced, in all cases attached to pieces of rock or other base, which would make it easy to remove them immediately if they proved unsuitable for the purpose in question.

If a large number of young plants made their appearance on the sides or front of the tank, it would not be a serious matter to run out the contents, scrub the surfaces clean, refill it, and replace the original plants.

By using the perennial species exclusively or mainly, it would be possible to depend solely or essentially upon specimens thus attached, and having these always in reserve, ruthlessly to exterminate any young individuals which might spring up at inconvenient times and places or in superabundant numbers, although it is more probable that our marine friends would in most cases save all trouble upon this point by anticipating the process.

Whoever among the managers of our public institutions will have the enterprise to try this experiment will probably set at rest one of the unsolved problems of aquarian management, and open up a new field of public interest and of scientific research by largely extending the list of animals which it is possible to keep in a state of health in the marine aquarium.

A. W. WILLS

THE NEW OBSERVATORY AT VIENNA

IN the *Monthly Notices* for November is an interesting paper by Dr. De la Rue on the preparations which are being made on the Continent for promoting physico-astronomical observations. The paper refers mainly to the new observatory which is being erected at Vienna, and the illustrations which we are able to give will enable our readers to form some idea of the plan of the building.

FIG. 1 represents the south front of the observatory, the central entrance opening into the dwelling of the director, which is to the south of the large dome.

"It is scarcely necessary for me to tell the Fellows of the Royal Astronomical Society," Dr. De la Rue says, "that their favourite branch of our science, namely, the physics of astronomy, is now engaging the earnest attention of foreign professional astronomers to a greater extent than obtained only a few years ago, and that grand preparations are now being made at several Continental State-observatories to grapple with the important truths which can only be revealed by adequate instrumental appliances such, indeed, as are far beyond the reach of most private fortunes. It was a matter of satisfaction to me to learn that photographic observatories are to be

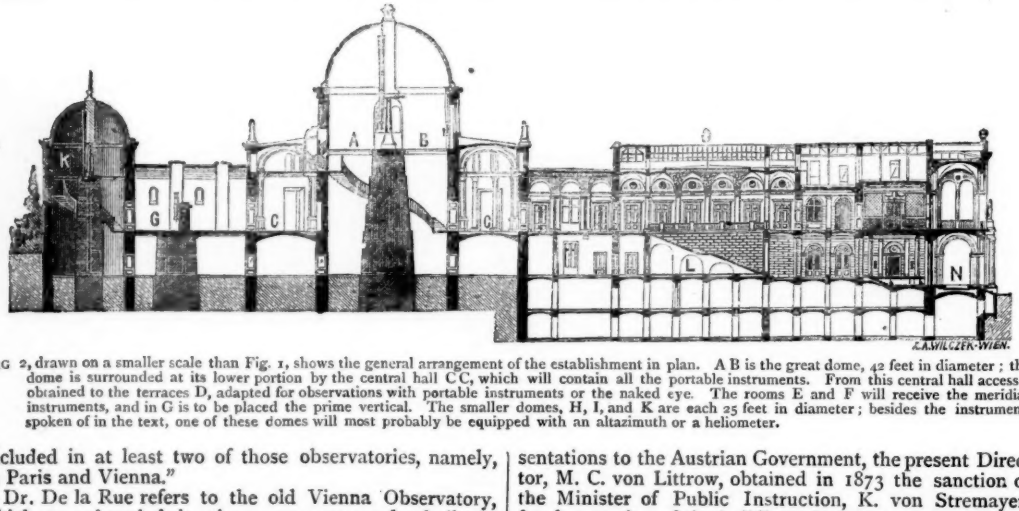

FIG 2, drawn on a smaller scale than Fig. 1, shows the general arrangement of the establishment in plan. A B is the great dome, 42 feet in diameter; this dome is surrounded at its lower portion by the central hall C C, which will contain all the portable instruments. From this central hall access is obtained to the terraces D, adapted for observations with portable instruments or the naked eye. The rooms E and F will receive the meridian instruments, and in G is to be placed the prime vertical. The smaller domes, H, I, and K are each 25 feet in diameter; besides the instruments spoken of in the text, one of these domes will most probably be equipped with an altazimuth or a heliometer.

included in at least two of those observatories, namely, in Paris and Vienna."

Dr. De la Rue refers to the old Vienna Observatory, which was founded in the year 1753, and rebuilt in 1826-27, but has been long so crowded round by other buildings as seriously to interfere with the satisfactory performance of astronomical work. After repeated representations to the Austrian Government, the present Director, M. C. von Littrow, obtained in 1873 the sanction of the Minister of Public Instruction, K. von Stremayer, for the erection of the building which is now approaching completion. The new observatory is about three miles to the north of the centre of the city, and was not commenced before Prof. Weiss, First Assistant at the Obser-

vatory, had visited the principal observatories in England and America, and the workshops of the first instrument makers in these and Continental countries. The site of the observatory, of which the foundation-stone was laid in June 1874, is a plateau of between 14 and 15 acres at an elevation of about 200 feet above the mean level of Vienna. The observatory is 330 feet long in the direction of north-south, and 240 feet in that of east-west. It is hoped that the building will be completed in 1877, and Dr. De la Rue, judging from the progress which had been made when he visited it in October last, believes it will be ready to receive the instruments at that time.

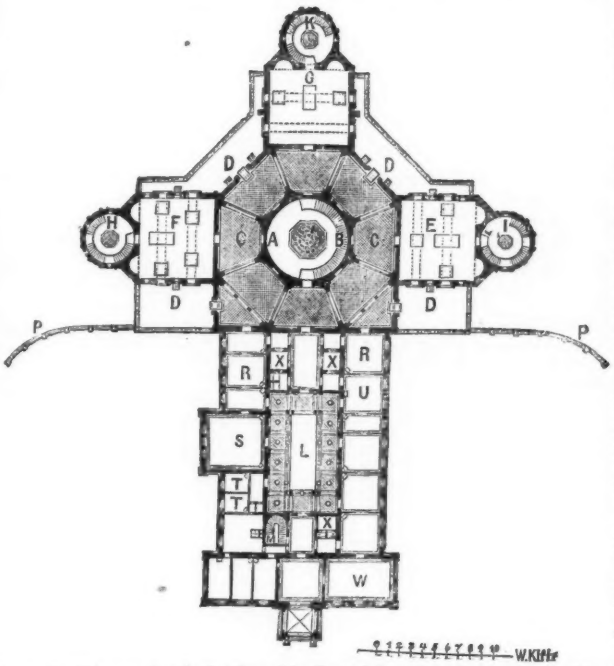

FIG. 3.—It will be seen that the first floor of the director's house is on the same level as the ground floor of the observatory; the apartments of the assistant astronomers are on the ground floor. C C show the section of the gallery surrounding the ground-floor of the great dome; L, the section of the staircase. Referring again to Fig. 2, W is the director's house in plan; S and T T, the library; U, the lecture theatre; and lastly, R, the offices.

The principal instrument of the observatory will be a refractor of about 26 inches aperture, to occupy the central dome of 42 feet internal diameter, both of which, as well as three smaller domes, two of which are shown in Fig. 1, are being constructed by Mr. Howard Grubb of Dublin. One of these smaller domes will contain an equatorial refractor of 12 inches aperture, by Mr. Alvan Clark, of Cambridgeport, Mass. "These two instruments, together with a meridian circle having a telescope of 8 inches aperture, and augmented by the instruments in the old observatory, will constitute the first equipment of the new establishment. Later on it is intended to place in the third dome an equatorial reflector specially adapted for photography, and also a prime vertical instrument in the room near the fourth dome, to the north of the central dome."

One arrangement, which Dr. De la Rue, with some justice, considers a drawback to an otherwise admirably arranged establishment, is that the buildings comprise the dwellings of the director, and apartments for the assistant astronomers. Although this arrangement will no doubt add to the comfort of the astronomers, "it would have been," Dr. De la Rue says, "in my opinion, preferable for the dwellings to have been detached, as the heated air emanating from them will be liable to disturb the definition of the instruments." We hope, however, that practically no real inconvenience will arise from this arrangement.

"From the preceding description it will be seen," Dr. De la Rue concludes, "that Austria will not be left behind in the steps which are being taken to promote physico-astronomical observations; and I sincerely hope that our own Government will ere long adopt measures to ensure to England a fair chance of honourably competing in the advancement of that branch of astronomical science which the Fellows of this Society have done so much to promote mainly from their own individual resources."

THE ROYAL SOCIETY COMMITTEES

FEW outsiders are aware of the amount of administrative work done by the Royal Society by means of its numerous committees. The work in this direction done during the past year is so well set forth in the recent anniversary address (just published) of the president, Dr. Hooker, that an abstract of it will no doubt be interesting to our readers. The principal committees are the Eclipse Committee, the Transit Naturalists' Committee, the Arctic Committee, and the *Challenger* Committee.

The first enterprise referred to by Dr. Hooker was the Arctic Expedition, in the scientific equipment and instructions of which the Royal Society took an important part. Referring to the cruise of the *Valorous*, Dr. Hooker stated that it was through the representations of the Royal Society that Mr. Gwyn Jeffreys and an assistant were appointed to carry on temperature soundings and deep-sea dredging.

"Capt. Loftus Jones and Mr. Jeffreys dredged on the Greenland coast from 70° 30′ N. lat. to the entrance of Davis's Straits, and in the Atlantic as far as 25° 58′ W. long., in depths of which the greatest was 1,785 fathoms; and temperature-soundings were taken at eleven out of the twenty stations indicated in the Admiralty Instructions.

"Among the valuable results obtained are the fact that the fauna of the Greenland seas agrees with its land flora in being mainly Norwegian, there being (with the exception of the Echinoderms) an absence of many North-American forms, which, as it appears, have not been found eastward of the meridian of Cape Chidley in Labrador. A remarkable mollusk, previously dredged at a depth of about 1,000 fathoms off the coast of Portugal by the *Porcupine*, and which, when first found in a fossil state in the newer tertiaries of Sicily was supposed to be an extinct type, reappears in the deep waters of Davis' Straits; and a *Campanularia* was found, specifically identical with one discovered this year in the opposite hemisphere, viz. in Kerguelen's Land, by Mr. Eaton, the naturalist of the Transit of Venus Expedition to that island. A most singular sponge-like diatom, named by Dr. Dickie *Synedra Jeffreysi*, with living *Globigerinæ* entangled in the colloid collecting-matter of its frustules, was taken in the towing-net.

"The existence of a remarkable elevation of the floor of the ocean was ascertained in lat. 56°N., long. 34°42′ W., where soundings of 690 fathoms were obtained between depths of 1,450 fathoms on one side and 1,230 fathoms on the other—an interesting fact when taken in connection with H.M.S. *Bull-dog* having found a similar elevation in lat. 59° 40′ N. and long. 29° 30′ W. It makes known the probable existence of a submarine ridge running N.E. and S.W. between Great Britain and Greenland."

With regard to the Transit of Venus Expedition, Dr. Hooker referred to the results obtained by the naturalists, who, on the recommendation of the Council, were appointed to accompany the expeditions to Rodriguez and Kerguelen's Land; in the former case Messrs. Balfour, Gulliver, and Slater, and in the latter the Rev. A. E. Eaton. With many of the results obtained by these naturalists our readers have already been made acquainted.

Rodriguez, Mr. Balfour has shown, is, after all, a volcanic island, possessing neither granite nor sandstone, but composed wholly of igneous rocks, with patches of coralline limestone along the coast. It belongs, therefore, geologically and geographically, to the Mascarene group. The general characters of its fauna and flora approximate very closely to those of the Mauritian group, upwards of 300 miles westward. Dr. Hooker then referred to the remains of extinct birds, including those of the Solitaire, and of extinct tortoises, which have been found in Rodriguez. Mr. Slater is of opinion that both classes of remains were entombed subsequently to the visits of Europeans. With regard to Mr. Balfour's Report on the Flora of Rodriguez, Dr. Hooker stated it as a very remarkable fact that one of the two new genera of flowering plants which have been found belonging to the natural order Turneraceæ, is most closely allied to a peculiar Panama genus; and that one of the new species has only a single congener, which is a Pacific Island plant.

Mr. Eaton's Report on the Natural History of Kerguelen's Land we have already given at length in vol. xi. pp. 35, 75. Full information as to the results obtained by all the naturalists will be published, and, after a complete set has been reserved for the National Collections, the remaining specimens will be distributed. The total expenditure incurred was 1,512*l.*, of which 1,396*l.* has been contributed by Her Majesty's Government, and the rest has been defrayed out of the Donation Fund.

With respect to the Total Eclipse Expedition of April, 1875, Dr. Hooker speaks as follows:—

"Towards the close of last year (1874) the desirability of observing the total eclipse of the sun, which was to take place in India, engaged the attention of your Council; and the subject was under its consideration when a letter was received by me from His Majesty the King of Siam, offering hospitality and assistance should the Royal Society deem it expedient to appoint scientific men to observe it from His Majesty's dominions.

"Your Council being of opinion that both the importance of the occasion (totality during this eclipse being of longer duration than during any other that would be observed in the present century) and the liberal offer of His Majesty required careful consideration, appointed a committee of five astronomers and the Society's officers to report upon the feasibility of undertaking such an expedition with a reasonable prospect of success. The Committee was advised that no time was to be lost in arriving at a conclusion, as only four months would elapse before the occurrence of the eclipse.

"The first step taken was to communicate with the First Lord of the Treasury and the Secretary of State for India, and ascertain whether, should the attempt be made, Her Majesty's Government would be disposed to co-operate with the Society.

"The answers were most favourable; but still grave doubts were entertained by several of the Committee as to whether it were possible to make the necessary preparations and arrangements with sufficient completeness to secure adequate results.

"After much deliberation it was decided in the affirmative, the Committee's decision being based on the following favouring circumstances:—That confidence in its feasibility was expressed by those members of the Committee who had themselves conducted or accompanied eclipse expeditions in foreign countries; that two eminent observers, Messrs. Janssen and Tacchini, were already in India and their services available; that Her Majesty's Government would co-operate by proposing to Parliament a grant in aid of 1,000*l.*, which would be augmented by another of 300*l.* from the Donation Fund of the Society; that the Secretary of State for India and the Governor-General of India had promised active co-operation by sending an expedition to the Nicobar Islands, where, as well as in Siam, totality would be visible; that both the Indian Government and the Admiralty had granted passages in their vessels, and that the Peninsular and Oriental Company had offered to give passages to the observers and their assistants at greatly reduced rates; that His Majesty the King of Siam would defray all expenses of the party sent to his territories; and lastly, which perhaps weighed most with the Committee, was Mr. Lockyer's disinterested offer to superintend all the arrangements of observers and instruments, to prepare the instructions for their guidance abroad, and to make all the necessary telegraphic and other communications with India and the Straits Settlements previous to, and during the progress of the expedition.

"As in the case of former eclipse expeditions, invitations to take part in the observations were addressed to foreign men of science distinguished for their researches in solar physics; but Prof. Tacchini was the only one who could accept. At the same time Dr. Vogel, of Berlin, a well-known photographer, was asked to assist, and he accompanied the expedition.

"A communication was received from M. Dumas, the perpetual Secretary of the Paris Academy of Sciences, with reference to Mr. Janssen's proposed observation of the eclipse; and instructions were sent to Singapore that every assistance should be afforded to that distinguished physicist.

"As a final result of these preliminary arrangements, there were two strong parties in position on the morning of the 6th of April, of whose members no less than six were sent out from England. One party, a combination of Italian, Indian, and English, went to Camorta in the Nicobar Islands; the other, French and English, made their way to Chulai Point in Siam. In the first party were Prof. Tacchini, Capt. Waterhouse, Prof. Pedler, Dr. Vogel, and Messrs. Meldola and Reynolds; in the second were Dr. Janssen, Dr. Schuster, Messrs. Lott and Beasley, each amply provided with assistants.

"The Committee decided that at both stations the observations should be mainly photographic; and the instruments furnished had for their object the registration of the violet spectrum of the corona and chromosphere as a whole, and that of the spectrum of an isolated portion of the image.

"Ordinary photographs of the corona and of the polariscopic effects of its light were also provided for.

"In spite of the most hopeful anticipations, the weather at Camorta proved bad on the morning of the eclipse, and, as has been observed on former occasions, the reduction of the temperature, due to the withdrawal of the sun's heat, produced a mass of cumulus cloud which prevented a most thoroughly equipped party from making any observations whatever during totality.

"The success of the Siam party has been also far less than was anticipated. An unfortunate break-down in the Suez Canal, and some misunderstanding, in consequence of which the promised Government steamer was not forthcoming, caused delays which left so little time for the final adjustment of the instruments when the observers at last reached their station, that some records are altogether wanting; and the attempt to photograph the spectrum of an isolated portion of the chromosphere proved a failure.

"The most important results obtained are (1) a series of photographs of the corona, taken with a prism of small angle in front of the object-glass, which show several rings and part of the form of the outer corona; and (2) a series of views of the corona, ceiefly taken at different times of exposure. The discussion of the observations has not yet been taken in hand; but it is not too early to state that several results of great interest and value have been secured.

"The King of Siam himself made a sketch of the corona and forwarded it to the Society. In common with others which accompany the reports, it does not differ very greatly from the figure photographed on the plate.

"I cannot conclude this short reference to one branch of our activity during the past session without congratulating English Science upon the fact that the eclipse was not suffered to pass unobserved, and without expressing our obligations to all those whose names will be mentioned at length in the report, who both here and abroad at each stage of the arrangements afforded us valuable assistance, not forgetting the observers themselves, who in the service of science volunteered for a duty not without risk, and from the performance of which, indeed, some have suffered in health."

Dr. Hooker next referred to the *Challenger* expedition, and to the interesting discoveries "which seem literally to have crowded along the course of the vessel." He referred to the light thrown by the *Challenger* researches on the formation of azoic clays and schists, on submarine geography, and on the distribution of pelagic life.

"In the depths of the sea, as on the surface of the land, are contiguous areas peopled by very different assemblages of living things. As on the land we ascend to meet a colder temperature, accompanied by forms of life of wider distribution than at lower elevations, so in the seas of warm and temperate regions we descend to meet with analogous conditions. The ocean thus mirrors one of the most striking features of the distribution of terrestrial life, and, mirror-like, it turns the picture upside down. Furthermore, this analogy is confined to the warm and temperate zones of the sea; in the cold zones this order of things is reversed; there, as on land, we descend to warmer temperatures, and the deepest sea is peopled by animals proper to a much lower latitude. The total result is a uniformity in the general

distribution of oceanic life that has no parallel on land; and facts in the migration of marine animals and plants that were formerly accounted for by assuming that they possessed greater powers of withstanding changes of temperature, are now accounted for by conditions more closely resembling those that obtain on the land."

Dr. Hooker then referred to the lamented death of Dr. von Willemoës-Suhm, and to the arrangement whereby Prof. Huxley has been able to act as Prof. Thomson's substitute at Edinburgh.

Speaking of the Meteorological Committeee, Dr. Hooker stated that "the anomalous connection between the Royal Society and the Meteorological Office on the one hand, and between that office and the Government on the other, is likely soon to be terminated, the Lords Commissioners of the Treasury having appointed a Committee to inquire into the working of the present office, and the value of the results hitherto obtained. According to the instructions of the Treasury, the inquiry is to be directed to two principal points of scientific interest, viz. (1) How far the statistics hitherto collected have led to the discovery or confirmation of meteorological laws. (2) How far the principles upon which storm-warnings are given have been justified by results."

While pointing out that America was in some respects more advantageously situated than England for meteorological investigation, Dr. Hooker showed that, on the other hand, England has advantages for promoting the study of terrestrial meteorology that no other country has—namely, her foreign possessions and colonies, and the command of the telegraphs with which the ocean is in process of being crossed in every direction. "We have known," he says, "what it is to read at our breakfast-tables telegrams from all parts of the world of the prices of stocks and of political incidents of the previous day; why should we not, then, obtain daily statistics of the climatic conditions of these and other remote regions, and inaugurate in England a system of meteorological registration which, if its elements were obtained from but a few well-selected spots, would instruct and interest every intelligent person in the climate of the globe, and in the end lead to scientific results of great value."

Dr. Hooker cannot but think that the Committee of the Treasury will have the opportunity of recommending to Her Majesty's Government the adoption of measures that would greatly increase the scientific efficiency and public interest of the Meteorological Office.

Dr. Hooker referred in terms of disappointment to the unexpected interpretation which has been put by the Law Lords on the terms of the Gilchrist bequest, whereby no part of it can be allotted to "the advancement of learning" *i.e.* of research, but all to the propagation of knowledge. Dr. Hooker hopes that a future and more enlightened generation "will introduce into the theory and practice of the law an interpretation of the 'advancement of learning' more in harmony with scientific ideas and the requirements of the age."

The president concluded his address by alluding to the Government Loan Collection of Scientific Instruments, which is being formed at South Kensington.

"In the proposed exhibition not only are modern scientific methods and instruments, and the various methods of practical instruction in science to be fully dealt with, but it is also proposed that the history of science shall be illustrated by the actual instruments which have been employed from the time of Galileo downwards, in those critical experiments and discoveries which mark the principal stages along the road of progress."

THE FRENCH ACADEMY AWARD OF PRIZES

AT the anniversary meeting of the Paris Academy of Sciences on Dec. 23 the following prizes were awarded as the result of the competition for 1875:—

1. Grand prize in the Mathematical Sciences, not awarded, and the subject re-set for competition in 1878—"Investigation of the elasticity of crystalline bodies from the double point of view of experiment and theory."

2. Grand prize in the Physical Sciences. The subject was, "To investigate the changes which take place in the internal organs of insects during complete metamorphoses." The prize was awarded to M. Künckel, Assistant-Naturalist at the Paris Museum.

3. The Poncelet prize, to M. Darboux, for his analytical and geometrical works.

4. The Montyon prize in Mechanics, not awarded.

5. The Plumey prize of 2,500 francs was awarded to M. Madamet, French naval engineer, for an apparatus invented by him to indicate at any moment the number of turns made by a marine steam-engine by the simple inspection of a dial, and without the need of employing a watch.

6. Fourneyron prize of 1,000 francs, to M. Sagebien.

7. The Lalande prize in Astronomy, to M. Perrotin, of the Toulouse Observatory, for his astronomical work generally, but specially for his discoveries of small planets.

8. The Lacaze prize in Physics, 10,000 francs, to Prof. Mascart, for his researches on the solar spectrum, on the measure of the dispersion of gases, on the influence which the motion of the earth has on optical phenomena, and for his investigation of the rate of light.

9. Montyon prize in Statistics, to M. Borius.

10. The Jecker prize of 5,000 francs awarded to M. Edouard Grimaux for numerous researches in Chemistry, more especially in chemical synthesis.

11. The Lacaze prize in Chemistry, 10,000 francs, to M. Favre, Dean of the Faculty of Sciences of Marseilles, for his great work on the transformation and equivalence of chemical, physical, and mechanical forces. It was while pursuing his researches in thermo-chemistry, commenced thirty years ago in conjunction with Silbermann, that M. Favre was led to investigate the great question of the equivalence of work effected by forces of different origin. M. Favre, giving an experimental demonstration of the most ingenious of Joule's views, made use of his mercury calorimeter, in the form of a thermometer in whose reservoir may be placed one or more elements. He thus established that the heat developed by resistance to the passage of electricity in the conductors of a simple voltaic couple, is simply borrowed from the total heat due to the chemical action which engenders the current; if this resistance to the passage of electricity be annulled we obtain, as the work of the pile with closed circuit, the quantity of heat which will be due to chemical action alone without the transmitted electricity.

12. The Barbier prize in Medicine, to Prof. Rigaud.

13. The Desmazières prize divided between M. Eugène Fournier, author of two memoirs on the Ferns of Mexico and of New Caledonia, and M. Emile Bescherelle, author of two memoirs on the Mosses of the same countries.

Prizes 14, 15, and 16 not awarded.

17. Grand prize in Medicine and Surgery, to M. Onimus.

18. Montyon prize in Medicine and Surgery. These prizes, of 2,500 francs each, were awarded to M. Alph Guérin, M. Legouest, and M. Magitot respectively. "Encouragements" of 1,500 francs each were awarded to M. Berrier-Fontaine, to M. Pauly, and to M. Raphaël Veyssière.

19. The Bréant prize not awarded.

20. The Godard prize in Medicine, awarded to M. Alph. Hergott.

21. The Serres prize not awarded; but a reward of 3,000 francs was given (1) to M. Campana for his researches on the anatomy and physiology of the respiratory and digestive apparatus, and of the serous membranes of birds; and (2) to M. Georges Pouchet for a MS. work on the development of the skeleton, and especially the cephalic skeleton of osseous fishes compared with that of some other vertebrates.

22. The Chaussier prize in Medicine, of 10,000 francs, divided between M. Gubler, M. Le Grand du Saulle, MM. Bergem and l'Hote, and M. Manuel.

23. The Montyon prize in Experimental Physiology, 764 francs, to M. Faivre, Dean of the Faculty of Sciences of Lyon, for his researches on the functions of various parts of the nervous system of insects. M. Faivre has established that among insects the localisation of function and the division of physiological work, are carried further than is generally supposed.

24. The Lacaze prize in Physiology, 10,000 francs, awarded to M. Chauveau, Director of the Veterinary School of Lyon, for his researches on virulent and contagious diseases. M. Chauveau has proved that the virulent activity of the vaccinal, variolar, and glanderous virus is not due to the liquid, as a whole, but oftenest to corpuscles which are held in suspension. M. Chauveau has, moreover, discovered that the agents of contagion have not only as a vehicle the liquids which come from the bodies of the sick, but that they may be transmitted to healthy animals by means of air and water. He shows that the human variola is a distinct malady by itself, of which the primary source is the organism of the horse.

25. Montyon prize, in connection with unhealthy occupation, 2,500 francs, to M. Denayrouse for his invention to protect workmen while in the midst of an irrespirable medium.

26. The Tremont prize, 1,000 francs, having been awarded for three years, 1873-75, to Prof. A. Cazin, an "encouragement" of 500 francs was awarded to M. Sidot for his researches on the various conditions of carbon and on the protosulphuret of carbon.

27. The Gegner prize of 4,000 francs was awarded to M. Gaugain to assist him in pursuing his researches on electricity and magnetism.

28. The Laplace prize, consisting of a complete collection of the works of Laplace, was awarded to M. Bonnefoy, "dux" of the École Polytechnique in 1875.

NOTES

PROF. HUXLEY, on Tuesday last, at the Zoological Society, in his paper on *Ceratodus*, in describing the brain of that fish for the first time, showed how closely it approached that of the Lepidosiren, and how that in some points it resembled the Selachian rather than the Ganoid type. He gave cogent arguments against the theory of Gegenbauer with reference to the typical conformation of the fore limb, and laid special stress on the affinities of the animal with *Chimæra*.

THE Crown Prince and Princess received the leading German scientific men on Monday at Berlin, in order to confer upon the means of securing an adequate representation of Germany in the exhibition of scientific intruments to be held in London next May. Besides Doctors Achenbach and Falck, the Ministers of Commerce and Education, there were present Herren Kirchhoff, Dubois-Reymond, Dove, and Foerster, as physicists; Herren Hoffmann and Maghellans, as chemists; and Herren Reuleaux and Siemens as representatives of mechanical science. Mr. Cundiffe Owen, the Director of the South Kensington Museum, was present at the audience. A German committee was formed to promote the objects of the meeting. This is the latest adhesion to the scheme, and we are now able to say that the arrangements are complete in the case of Germany, the United States, Belgium, Holland, and Switzerland. In all these countries, committees appointed by Government are collecting instruments either for the Research, the Historical, or the Educational department.

THE following extract from the Order Paper of the Legislative Council of New Zealand, Oct. 19 last, seems to show that a supposed prehistoric man may perhaps become the subject of a judicial inquiry. The skeleton in question was exhumed in the course of excavations made for Moa bones and associated human remains by Dr. Haast, as detailed in his paper ("Trans. N.Z. Institute," vol. vii.), and as that author holds strongly to the Palæolithic age of the deposit, while others assert its comparatively recent date, it will be interesting to observe what light the coroner's inquest will throw on the subject:—"The Hon. Mr. Mantell to move, That there be laid upon the table copies of any proceedings at any inquest held upon a body found, under suspicious circumstances, in a cave known as the 'Moa Bone Point Cave,' at Sumner, in the Province of Canterbury, on Saturday, Oct. 19, 1872, whose skeleton is reported to be in the Christchurch Museum. And, in the event of no such inquest having been held, that the Government lay upon the table a statement of the reasons why no inquest was held; or assure the Council that instructions will be forthwith issued to the proper authorities to make such inquiry as may, if possible, lead to the identification of the individual whose body was so found, and set at rest any doubts as to the manner in which he came by his death."

WE would draw the special attention of our readers to a paper in the current number of the *Journal of Mental Science*, by Dr. Herbert B. Major, entitled "Observations on the Brain of the Chacma Baboon." Having, in his Graduation Thesis before the University of Edinburgh, shown that in the smaller apes the size of the nerve corpuscles of the cortex of the occipital lobes was less than in the human subject, the author has analysed, layer by layer, the cortical substance of the brain of the chacma and man, his observations as yet being entirely negative. The points investigated are the number and appearance of the layers; the character of the nerve-strata; also the vessels and the white medullary substance.

THE large female chimpanzee, Mafoka, at Dresden, which has recently attracted so much attention, died, we regret to say, a short time ago. Dr. Meyer promises us an account of the animal.

A PAPER by Prof. Reinhardt has recently been published at Copenhagen, on the Glyptodon remains of Brazil, together with the account of a new species, *Glyptodon* (?) *dubius*.

THE *éloge* of General Poncelet at the anniversary of the Paris Academy was the occasion of a pathetic scene. A tribune had been set apart for the use of Poncelet's widow, who was sitting with her lady companion. When M. Bertrand referred to the attentive care which had surrounded the last days of the departed geometer, and the real worship paid to his memory by the noble woman who had been his wife, Madame Poncelet could not restrain her weeping, and her emotion was communicated to the whole audience. The house was crowded by friends and pupils of Poncelet.

THE Meteorological Society of Paris has elected M. Janssen president for 1876. Mr. R. H. Scott, the director of the English Meteorological Service, has been nominated a member of the Council, and M. H. St. Clair-Deville one of the vice-presidents.

AT a recent meeting of the Vienna Geological Society, the Director, M. von Hauer, welcomed Dr. E. Tietze, who, after more than two years' sojourn in Persia, had safely returned to Vienna. He made extensive geological researches, especially in Mount Elburz, and eastward as far as Asterabad and Sharood. He visited, besides, the environs of Asabeidshan, Ispahan, Chamjar, and the province of Farsistan, as also the salt desert south-east of Teheran.

THE "Results for 1873 of the Meteorological and Magnetical Observations taken in Victoria, Australia," have been received. In addition to the usual averages, which appear to be carefully made, Prof. Ellery gives valuable summaries of electrical phenomena, hailstorms, frosts, snow, sleet, gales, and strong winds, together with a detailed statement of the "hot winds" which have occurred during the year in different parts of the colony, and which form so important a feature of the Australian climates. The publication is accompanied with a map, showing the positions of the meteorological stations and the telegraph and railway routes.

FROM Dr. King's recently-issued report on the cinchona plantations in British Sikhim, which we have previously noticed, we learnt for the first time that an efficient febrifuge was being made and sold at a cheap rate in India. On this subject Mr. Gammie, the resident manager of the Government plantation at Darjeeling, writing to Dr. Hooker, says: "We are now busy collecting cinchona bark, and propose to collect about ninety tons of dry bark this season, which we can easily do. We are manufacturing it on the spot into a cheap febrifuge, which is evidently quite as effectual as quinine. The medical department appears to be taking kindly to it, for within the last three months I have sent them over 600 lb. of it, and they are asking for more. We are now making from 40 lb. to 50 lb. a week, but are daily expecting orders to extend our factory, so as to make at least double that quantity. We have good hopes of being able to sell the febrifuge at one rupee an ounce and pay all expenses." Mr. Wood, the Government Quinclogist, has, it appears, been appointed to officiate as Professor of Chemistry at Calcutta, and since his departure for the capital, the manufacture has fallen upon Mr. Gammie.

PROF. C. HOLTEN has sent us "Tables Météorologiques de Copenhague pour l'année 1874," prepared by him, and published under the auspices of the Royal Danish Academy of Sciences and Letters. A special feature of this publication is the long averages which appear with the monthly sheets of observations. As regards rain, the averages are for fifty-five years, and as regards temperature for ninety-two years. The temperature averages are particularly valuable, seeing that they are given for this long series of years for each day, each five-days period, and each month of the year.

THE contents of the Southport Aquarium have been studied with marked interest by a large number of persons during the Christmas holidays. Amongst recent additions is a very fine specimen of *Alligator lucius*, from New Orleans, more than 8¼ feet in length, a very large number of young alligators, some only a few inches, a school of herrings of all sizes, two masses of living sponge containing large colonies of brittle star-fish, young skate hatched in the aquarium, in the octagonal table tanks, which also contain a magnificent collection of sea anemones, echini, living bivalve shells, zoophytes, annelids, and seaweeds. Amongst recent improvements noticeable in this aquarium is the placing of sheets of india-rubber between the plate-glass fronts of the wall tanks and the iron mullions, which has had the effect of entirely preventing the cracking of the glass from sudden changes of temperature. The quantity of water circulating in the tanks has been increased, fresh supplies being only received to compensate for evaporation. The company have a large number of iron tanks placed at the end of the pier to receive at once rare fish brought in by the deep-sea trawlers.

WE regret to hear of the death of Mr. James Hinton, well known as a writer in practical physiology and in philosophy.

M. GERMER BAILLIÈRE, the enterprising editor of the *Revue Scientifique* and *Revue Littéraire*, has started two new periodicals, an "Historical Review," quarterly, and a "Philosophical Review," monthly.

A TRIBUTE of respect was paid by the late French National Assembly to the learned Minister of Public Instruction, M. Wallon, who was elected a life-member of the Senate, representatives of every political party having voted for him, although he had declined to stand as a candidate.

THE Catholic University of Paris opened its course of scientific lectures on Dec. 27. The lecturer in higher mathematics is M. Serret (not the well-known member of the Institute). The lecturer in physics is M. Brauly, who was the *préparateur*, or general assistant of M. Desains, the Sorbonne lecturer. No lecturer has yet been found for botany.

THE establishment of a School of Mines at Lille is in contemplation.

AN Imperial ordinance, published on Jan. 1, directs that the thanks of the Russian Government be conveyed to Prof. Nordenskjöld, for his exploration of the Polar Sea up to the Yenisei River.

THE Government has ordered that the annual cost of the Ordnance Survey of the United Kingdom shall be reduced. During the past and present week a large number of civil assistants at the head-quarters at Southampton have received their discharge.

EXPERIMENTS will be tried in France within a very few days with a new system of taking up and depositing letter-bags from a railway-train running at a great velocity. The apparatus, which was invented by a chief telegraphist, is entirely self-working, and great expectations are raised by the French Administration. A waggon of the Lyons railway has been entirely fitted up on the new principle, and a special post for collecting and delivering has been erected in the Varenne St. Maur Section.

A SPECIAL meteorological monthly paper has been published by M. H. St. Clair-Deville, who has just organised the Algerian Meteorological Service. The first number was issued a few days ago.

MOST interesting experiments are now being conducted at the Northern Railway Station, Paris, in the use of light generated by gramme magneto-electric machines. Success has been only partial, owing to the want of motive-power, but hopes are entertained of a speedy and successful result.

WE are glad to see from No. 2 of the *Iowa Weather Review*, that the scheme of meteorological observations for the State of Iowa has thus far proved a success. For the first decade of November, Dr. Hinrichs received eighty station reports from all parts of the State. A report of the results is at once prepared and forwarded to the newspapers for publication. The rest of the *Review* is taken up with minute directions as to the method of observing for the purpose of securing accuracy, uniformity, and fulness in the results of the observations embraced by the scheme.

MR. MURRAY has issued cheap editions of the narratives of Livingstone's first and second African expeditions. In the case of the former the cheap edition seems to be a reprint of that published during the author's lifetime, while the second is somewhat abridged. Both are neatly got up, contain most, if not all of the original illustrations, and will be welcomed by many who desire to possess the original narratives of the work which has made Livingstone immortal.

A REMARKABLY valuable discussion by M. Belgrand, of the inundations of the Garonne, viewed specially in connection with the heavy rains which fell over France from the 21st to the 24th of June last, has been appearing at intervals for the past fortnight in the *Bulletin International* of the Paris Observatory. It is pointed out, from the dates of their occurrence, that the inundations of the southern portion of the basin of the Garonne which slants from the Pyrénées, have nearly always occurred in spring or early summer, and at the same dates either no floods at all, or comparatively unimportant floods, were experienced in the northern portion of the basin which slopes down from the Cevennes and central plateaux of France. It is to be noted that it is just at this season that the rainfall of the southern portion of France attains its annual maximum, and the nearer to the Pyrénées the more decidedly is the May-June maximum marked, and that the melting of the snows which have accumulated on the Pyrénées during the winter months proceeds most rapidly. On the other hand, it is shown that the great inundations of the northern portion of the basin occur generally during the cold months of the year, and that at the time of their occurrence there have been no corresponding great floods at Toulouse, in the southern portion of the basin. It is during the cold season that the rainfall reaches its annual maximum on leaving the slopes of the Pyrénées and advancing northwards over the basins of the Tarn, Lot, and Dordogne. The disastrous inundation of June, 1875, was in accordance with the experience of previous floods in the south of France. As a great flood it was limited to the river courses sloping down from the Pyrénées; and the nearest approach to a great flood elsewhere was in the basin of the Argout, the most southern tributary of the Tarn, and it was the flood of this tributary which occasioned almost the whole of the flood of the Tarn. At such places as Auch, situated in a narrow valley, and where, consequently, the drainage area is small, the inundation was much less disastrous than at Toulouse and places similarly situated

near the confluence of large affluents draining a wide extent of country. The following official statement of the numbers of the persons drowned, classed according to the departments, will indicate the line of greatest devastation :—Ariège, 73 ; Gironde, 1 ; Haute Garonne, 330 ; Lot-et-Garonne, 20 ; Tarn-et-Garonne, 116 ; total, 540. The discussion of these inundations with reference to the season of the year in which they have occurred in different portions of the Garonne basin, and in their relations to the physical configuration and annual maximum rainfall of each district, indicates a line of inquiry which, if further prosecuted, cannot but lead to most important practical results.

THE additions to the Zoological Society's Gardens during the past week include three Moose or Elks (*Alces machlis*) from N. America, two Arabian Gazelles (*Gazella arabica*) from Arabia, deposited ; a Pig-tailed Monkey (*Macacus nemestrinus*) from Java, presented by the Rev. W. Ewart ; a Green Monkey (*Cercopithecus callitrichus*) from W. Africa, presented by the Rev. J. W. Ayre ; an Earle's Weka Rail (*Ocydromus earlei*) from New Zealand, presented by Capt. H. Braddick.

SCIENTIFIC SERIALS

Bulletins de la Société d'Anthropologie de Paris, fascicules 2, 3, 1875.—The former of these numbers gives the discussion which followed the reading of a paper by M. Pommerol, on the rock-excavations, basins, rocking-stones, and holes observable in many of the rocks of Puy-le-Dôme. Contrary to the view which he had advanced in regard to their connection with prehistoric or early historic races, and their formation by man for domestic or religious purposes, the society generally concurred in the opinions maintained by MM. Leguay, Hamy, and Mortillet, that such formations are for the most part the results of natural causes, and that flint implements would have been incapable of acting upon the hard granite of which they usually consist. They admitted, however, that some of the depressions and holes may in a few instances have been enlarged in process of time through human agency, after having become the scene or object of superstitious veneration.—M. Morice laid before the Society a report of the various races which now occupy Cochin China, the most numerous and characteristic of which are the Annamites and Cambodians. Next in point of numbers stand the Chams and the Mois, or mountain-men, and beside these a hybrid race, half-castes between Annamites and the Chinese settlers, and known as Minuongs, is rapidly attaining consideration as a distinct class.—M. Hamy gave a brief summary of a memoir, which he will soon publish *in extenso*, on the craniological characters of the race that now occupies the Island of Timor, and which he considers to be not far removed from the Papuan Negritos. His examination of a number of Timorian skulls has led him to accept as proved the distinctive characteristics assigned to the race by Owen, Busk, and De Quatrefages.—M. Topinard's paper on Australian hybrids gave rise to a long discussion, but can scarcely be said to have contributed directly or indirectly to the elucidation of any of the difficulties involved in the subject.—M. Piette's communication of the result of his exploration of the Gourdan and Lortel caverns is interesting from the fact that, in addition to the ordinary reindeer-lion, aurochs and other animal remains found in such caves, he discovered parts of two human jaws. One of these—the lower maxillary bone of an adult man, to which several much-worn teeth were still attached—was found at Gourdan in close proximity to bones referred by the author to *Cervus canadensis*, or a closely allied form. The other jaw, apparently that of a child of seven, who had died during dentition, was excavated from the floor of the Lortel cavern at a depth of 6 metres.—M. Condereau laid a paper before the Society, and explained the elaborate series of tables which he has constructed to illustrate his system of the classification of articulate sounds, and which he hopes to see accepted by anthropologists as the basis of some uniform phonetico-physiological alphabet, by which writers of different nationalities may be brought on a common ground for the comparison of the different articulate sounds of which the human voice is capable.—M. Broca brought under the notice of the Society a negro skull belonging to their museum, where it forms the fifteenth in the Gannal collection, in order to show how the normal parietal foramina may present such unusually large dimensions as to assume after death the appearance of artificially produced parietal perforations. At a previous meeting of the Society, on March 18, M. Broca had exhibited a skull taken by M. de Palmas from an ancient cemetery in the Canary Islands, which presented a double parietal opening.—A very interesting and important paper was read by M. Broca on May 20, when he laid before the Society a *résumé* of the "Craniometrical Instructions" which they had commissioned him to draw up for the guidance of anthropologists. In accordance with the directions of the Commission these instructions are preceded by a description of the anatomy of the head, in which an entirely new anatomical nomenclature has been adopted, for which M. Broca craved the approval of his *confrères* on the ground of the obscure terminology hitherto in use in craniology. Among a number of novel terms we may instance such words as endocranium and exocranium ; pteron and discus for the ascending and the horizontal parts of the greater ala ; inion for the external protuberance of the occipital ; and basion, opisthion, staphanion, pterion for distinctive portions of the occipital, frontal, and temporal fossa. M. Broca announces that this new system of cranial terminology will be soon published *in extenso* in the "Memoires" of the Society.—M. Collineau, in connection with the subject of arrest of development in the osseous and other parts of the brain, as shown by M. Broca in his paper on parietal perforations, drew attention to the extraordinary spread of religious mania in France, of which he gave numerous instances amongst the higher as well as lower classes, and appealed to medical and other scientific men to devote themselves to the elucidation of this important subject.

Der Naturforscher, November, 1875.—This number contains an account of some interesting researches by M. Exner, on the capability of perceiving a time-difference between two impressions of sense. Suppose a stimulus to act at moment *a*, and another at moment *b*, how near may *a* and *b* come together and the impressions continue distinct? M. Exner examines the various cases of two impressions on the same, and on different elements of an organ of sense, on similar elements of a pair of organs, and on elements of different sense organs.—From experiments on decomposition of albumen in animal bodies, M. Forster concludes that the blood of one animal introduced into the vascular system of another behaves like the blood already present ; that albumen solutions brought into the blood are decomposed like albuminous substances received through the stomach and intestine ; and that, of the albumen present in the body, that which is firmly held in organs and cells is but little decomposed, while that entering the intestine or blood-vessels in solution is mostly decomposed.—The physical properties of a freezing mixture of sulphuric acid and ice are investigated in a paper by M. Pfaundler, and M. de Coppet discusses superfusion and supersaturation according to the mechanical theory of heat. Most of the remaining papers hardly call for notice here.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 16, 1875.—Note on the Placentation of Hyrax, by Prof. Wm. Turner, of Edinburgh. The author describes the result of his study of a spirit specimen, his object being to verify or refute the recent statements of MM. H. Milne-Edwards and George, which, contrary to the observations of Sir E. Home, Owen, Huxley, and others, are to the effect that the placenta of *Hyrax* is non-deciduate. He shows that the placenta of *Hyrax* is deciduate, like that in the cat, which it resembles in form ; it has also a large allantoic sac.

Geological Society, Dec. 15, 1875.—Mr. John Evans, F.R.S., president, in the chair.—Francis James Bennett, Alfred Allinson Bourne, Charles Thomas Clough, John Law Cherry, William Herbert Dalton, Walter Saise, James Weeks Szlumper, and Lamont Henry Graeme Young, were elected Fellows ; and Prof. August Quenstedt, of Tübingen, a Foreign Member of the Society.—"Notes on the Physical Geology of East Anglia during the Glacial Period," by Mr. W. H. Penning. The author wished it to be understood that his remarks were intended to form a sketch, rather than a detailed account of the subject to which they relate. He intended to explain the origin of the so-called "middle glacial" gravels and sands, to account for their occurrence in certain areas and their non-occurrence in others, where they might reasonably have been expected. Also to briefly describe a certain series of gravels of doubtful age and origin in the

Cambridge valley. A short description of the geology and physical features of the district was given, and an inference drawn from the varying faunas of the "Crag" that the land was sinking during that era and until after the deposition of the Cromer "Forest-bed." Then Arctic conditions began to prevail, and the great glacial subsidence commenced; the "lower glacial" beds were formed, and succeeded by a large series of false-bedded gravels and sands, with intercalated patches of unstratified clay. These deposits run up only to a certain level, about 300 feet, never quite reaching the top of the chalk escarpment, where the overlying boulder-clay is invariably found resting on the older rock, without any gravel or sand between. The author inferred from this circumstance that after the deposition of the "lower" beds, and as submergence went on, the waters of the North Sea were again united to those of the Atlantic. A strong current was thus set up, which swept down from the north, bringing with it the material of which the gravels are composed, and which is found to consist of pebbles, all derived from the northern and eastern coasts, mixed with flints from the chalk. The escarpment of this formation stood at the time above the water, but when once sufficiently submerged to admit the water over its lower portions, the conditions were altered, the current lost its force, and the deposition of gravel ceased. An occasional iceberg had dropped its load of unstratified clay, which became intercalated with the gravels, but the greater number of such bergs were quickly swept away to the south. Now the waters had access to a larger area, the formation of gravel was succeeded by that of boulder-clay, which in the author's opinion is entirely composed of masses of clay enclosing boulders, brought down and dropped by icebergs *in mass*, which accounts for its want of stratification. This boulder-clay rests evenly on and at the higher level overlaps the "middle glacial" sands; it then caps the chalk escarpment and plunges down into the Cambridge valley, even to the present level of the sea; but in no instance on or beyond the escarpment does any sand or gravel intervene between it and the older geological formations, although just over the scarp (on the south side) the gravels run up to an elevation of 300 feet. The gravel-forming currents were evidently confined to the seaward side of the chalk range, and excluded from the Cambridge valley, which is undoubtedly *pre-glacial*, and which formed at the time a large inlet, land-locked on every side but one, discharging its waters through the opening now occupied by the estuary of "The Wash." In the Cambridge valley there are sheets of river-gravel of recent date, some patches of doubtful age, but not traceable under the boulder-clay, and an elongated series of gravels at a level of 20 to 60 feet above the present level of the Cam. These are in some parts distant from the present course of the river, and present a striking resemblance to glacial gravels; but as they here and there contain recent shells, and taking into consideration their uniformity of level, the author concludes that they indicate an ancient course of the River Cam. The other conclusions arrived at, after mature consideration of all the evidence hitherto obtained, are—that a gradual passage will be found to exist from the base of the crag up to and through the drift-deposits to those of recent date; that in East Anglia we have evidence of but one, and that a gradual period of glacial submergence succeeded by a corresponding movement of re-elevation; and that there are no "middle glacial" deposits whatever within the area of the Cambridge valley.—"Denuding Agencies and Geological Deposition under the Flow of Ice and Water, with the Laws which regulate these actions, and the special bearing on river-action, of observations on the Mississippi and other great rivers, and their present and past Meteorological conditions, and similar remarks on Marine Deposits, illustrated by the Irish Sea and the Chesil Beach," by Mr. A. Tylor. The writer adduced evidence by measured sections and drawings to show that the Quaternary gravels were deposited rather in a wet or pluvial than in a snowy or Glacial period. He thought the denuding action of springs and the alternate action of rain and frost had been neglected. He considered Agassiz and other writers had overlooked the previous writings of Playfair, to whom he referred. The rainfall of Westmoreland, Switzerland, and the Mississippi valley were compared in summer and winter to prove that floods were not necessarily greater from land covered with snow than from land covered with trees and vegetation when height above the sea and local circumstances were taken into consideration. Mr. Dana's "Great Glacier," whose melting was to supply a Quaternary river, Mississippi, 50 miles wide, would require a supply equal to 625 times the present rainfall to fill it. The melting of snow was assumed to be of such proportions by modern writers as to equal the débâcles of older geologists. The high Swiss mountains pointed to a greater diminution of snow on high ground in the Glacial period; and he believed the clouds then discharged near the sea-level, so that the mass of snow and ice was at low levels. It appears that in Greenland in the 80th parallel, according to Nordenskiöld, near the sea in summer there is no snow on the ground 1,000 or 1,500 feet above the sea. Open water at the poles must depend upon the abstraction of the vapour from the atmosphere at lower latitudes; and probably in the Glacial period the ice-cap was thickest at the 70th parallel of latitude. Mr. Tylor thought the theories of former depressions of the land, as in the Mississippi valley, should be tested by examination for flexures. He had found (in 1868) that flexures, and fractures, had very much affected the course of the Wealden denudation in the Quaternary period. The laws of river motion are very simple and precise; and as depressions and upheavals are always unequal, any great movements in the Quaternary period would affect the courses of rivers, and be traceable in their deposits. The author had measured the *remaniés* valley gravels of Coalbrook Dale, which were associated with marine shells 200 feet above the sea, and compared their contour with ordinary valley gravels and with marine beaches, to ascertain under what probable conditions the sea had risen up the Severn valley without leaving any traces of cliffs or marine denudation except between Bridgnorth and Coalbrook Dale. The diamond gravel-deposits in Africa have a similar contour to those of Coalbrook Dale. The position of the Moel Tryfaen beds was first described by Trimmer in 1831. Trimmer, an excellent geologist, observed the scratches on the rocks covered by the gravel with marine remains, and noticed their ice-origin, but did not draw, unfortunately, the natural inference that there must have been a Glacial period in Wales. This great discovery or invention was left to Agassiz to propose in 1837. The glacier-eroded lakes, much lower than Moel Tryfaen, and close to it, are free from marine remains, therefore it seems difficult to suppose a depression of 1,300 feet and immersion in the sea of Tryfaen, and subsequent elevation, could have taken place without having left any marks on the land except at one spot. The measured section of the Chesil Beach shows its close approximation to a binomial curve, and the regularity of beaches and littoral zones along the Channel teach us what are the certain consequences of land being immersed under the sea. Mr. Tylor produced plans and sections showing how the tide actually affects the sea-bottom, and described the gorge below 50 fathoms in the Irish Sea. He treated the tide as caused by the alternate and opposite slow movement of the deep and great mass of the Atlantic, giving motion to the water at the coast almost simultaneously as if the whole water moved as one mass over an area of thousands of square miles. The velocity of the tide of one tenth of a mile per hour in a deep sea, produced by the composition of forces a tide of a velocity of three or four miles an hour on the coast. High and low water at different ports are the direct consequences of local currents in shallow water, set in motion by the greater mass of deep water. There are points in the English Channel where within a few miles there is a difference of six hours in high water. He objected to the theory of a tidal wave travelling in one direction, and moving faster in deep water than in shallow, because the tide really travels quicker in shallow water, as his plans show. In support of this he showed the chart of the Channel, and that the tide turned in the Irish Sea at all points, deep or shallow, almost simultaneously and synchronously with the slow tidal movement in the Atlantic. He found that in a large area of sea of 120,000 square miles, where the water averaged 67 fathoms off the Scilly Islands, the velocity of the tide was only one mile per hour, but in the shallows near the Channel Islands, where the depth was on an average 12 fathoms, by the composition of forces the velocity of the tide increased to 6 miles an hour. If the tide was the consequence of a tidal wave bringing high water, the tidal conditions of the Irish Sea would be very different from what they are described to be. He did not find any evidence of a plane of denudation on any sea coast, but, on the contrary, deep gorges and curved surfaces, depth varying with width, &c. The nearest approach to a plane surface was in the estuary of the La Plata; but that flatness appeared more the consequence of deposition than denudation. The great cuts or indentations out of coast lines where rivers discharge into the ocean, when compared with the absence of indentations in areas where there are no great rivers, but where the rocks are equally hard, showed that such denudation depended upon the alternate and opposite action of rivers and the tide. He referred to the removal of the bar

of the Danube, and to the great laws which regulate the flow of water, which he illustrated by diagrams. Hydraulics and meteorology must be studied in connection with the lines of denudation and deposition; and however difficult and inconvenient these subjects might be, no results would be reliable unless all the physical circumstances were taken into account.

Anthropological Institute, Dec. 28, 1875.—Col. A. Lane Fox, president, in the chair.—Major H. H. Godwin-Austin, E. Willett, Mrs. T. Cowie, and A. L. Lewis, were elected members.—Mr. John Evans, F.R.S., read a note on a proposed international code of symbols for use on archæological maps, which had been prepared by the sub-committee appointed at the Stockholm meeting of the Congress of Prehistoric Archæology.—Miss A. W. Buckland read a paper on divination by the rod and by the arrow. The author endeavoured to prove:—1. That from personal observation, rhabdomancy is still practised in England in certain localities, and that it is a survival of a very ancient superstition originating in the use of rods as symbols of power. 2. That the staff as a sceptre was probably a later form of the horn which was thus used in very early prehistoric times, and in that character adorned the heads of gods. 3. That from the use of rods or horns arose a veneration for them as possessing the inherent power of healing disease and even of restoring life. Hence their use by magicians in all ages and countries, the chief instruments employed by them being a ring or circle, and a staff and a bifurcated stick. 4. That these symbols conjoined are found in Egyptian, Assyrian, and Peruvian sculptures, and may be traced in some of the stone circles of Britain, and in the shape of Irish and African brooches and fibulæ. 5. That from the belief in the magical powers of rods perhaps arose tree-worship, or at least such veneration for trees as is observable of the oaks of Dordona and of the Druids, the ash of Scandinavia, and, for some unexplained reason, more particularly of the hazel. 6. That belomancy, or divination by marked arrows, said to be of Scythic origin, was practised in Babylon, Judæa, and Arabia, and that traces of it may still be found in the folk tales of Russia and Siberia. 7. That the mode of using these arrows had a strong resemblance to the very ancient custom of casting lots common to all peoples ancient and modern. 8. That the invention of lots and dice, as well as that of the divining rod, is ascribed to Hermes or Mercury identified with the Woden of Scandinavia, and by some writers also with the India Buddha. 9. That a strong resemblance exists between the implements of magic and the ancient alphabets, also the reputed invention of the same god or gods. 10. That many of the signs or letters forming the Archaic-Phœnician, and other alphabets, are found in the rock sculptures of Peru, thus adding one more to the many proofs of a communication existing between the hemispheres in prehistoric times. 11. That the arts of magic and divination were not of Aryan origin, but remnants of the Turanian or Pre-Aryan faith which once overspread the world. 12. That this is proved by their present existence among aboriginal non-Aryan races, and may, perhaps, even be used as a test of race, so that those who in Somerset and Cornwall are said to possess the power of divination by the rod may possibly have some remote affinity with the aboriginal inhabitants of Britain.

Victoria (Philosophical) Institute, Jan. 3.—Several new members were elected. The yearly statement showed the institute's sphere of action had been much extended of late. The Rev. R. Thornton, D.D., read a paper on "Scepticism," the concluding one of a series of four.

PARIS

Academy of Sciences, Dec. 20, 1875.—M. Frémy in the chair.—The following papers were read:—Theorems in which there are couples of segments having a constant relation, by M. Chasles.—Formula of the quantity of magnetism removed from a magnet by an iron contact, and of the portative force, by M. Jamin.—Critical remarks on the theories of formation of saccharoid matters in plants, and particularly in the beet, by M. Cl. Bernard.—Note on the order of Aug. 14, 1875, prohibiting the importation of fruit and other trees into Algeria, by M. Blanchard.—Expedition to Campbell Island; memoir on the chlorination of sea-water, by M. Bouquet de la Grye. The law enunciated by Gay Lussac and Humboldt for the saltness of the Atlantic is also true for the Pacific. Having represented graphically the relation between dilatation, temperature, density, and chlorination, the author seeks to analyse some phenomena of equilibrium of the sea.—Exposition of a new method for resolution of numerical equations of all degrees (second part), by M. Lalanne.—New researches on the interior magnetism of magnets, by MM. Trève and Durassier.—Researches on *Eucalyptus globulus*, by M. de Hartzen. The resin of *Eucalyptus* contains tannin and several fatty matters.—Action of mineral salts on the crystallisation of sugar, and determination of their coefficients, by M. Lagrange. Of the various salts contained in sugar, the chlorides are the least melassigenous; next come the sulphates and carbonates. The nitrates of potash and soda have the most prejudicial action to crystallisation.—Action of nitric acid on the phosphates and the arseniates of baryta and of lead, by M. Duvillier.—On the exchanges of ammonia between natural water and the atmosphere, by M. Schloesing. With the same tension of ammonia in the air, the quantity of alkali dissolved in a natural water, up to equilibrium of tension, decreases rapidly as the temperature rises.—On the propagation of heat in rocks of schistous texture, by M. Jannettaz.—On aniline black; observations on a communication of M. Coquillion, by M. Rosenstiehl.—Note on the action of ozone on animal substances, by M. Boillot. Fifty grammes of beef enclosed in ozonised air were fresh and unaltered at the end of ten days.—On the myology of carnivora, by M. Alix.—On the pathogeny of deaf-mutism, improperly called congenital, by M. Tripier. Only about a fifth of those said to be born deaf are so really. In the other four-fifths deafness comes suddenly about two or three years of age.—On a crystallised boride of manganese, and on the *rôle* of manganese in the metallurgy of iron, by MM. Troost and Hautefeuille.—On the oxyfluorides of niobium and of tantalum, by M. Joly.—Determination of alkaline metals in the silicates, and in matters unattackable by acids, by means of hydrate of baryta, by M. Terreil.—On a new mode of production of trichloracetic acid, by M. Clermont.—On the classification and the synonymy of the stellarides, by M. Perrier. On T nerve-tubes, and their connection with the ganglionic cells, by M. Ranvier.—On the nerve-terminations in the electric plates of the torpedo, by M. Ranvier.—Remarks on a memoir of M. Tschermak, on the geology of meteorites, by M. Meunier.—M. Milne Edwards presented the first volume of "The Natural History of the Mammifers of Madagascar," by MM. Grandidier and Alph. Milne Edwards.

VIENNA

Imperial Academy of Sciences, Nov. 11, 1875.—MM. Toldt and Zuckerhandl communicated a paper on the changes of form and texture in the human liver during growth.

Nov. 18, 1875.—A paper was read by M. Liebermann, on the chlorophyll of the colouring matters of flowers and their relations to the colouring matter of blood. He thinks chlorophyll consists of two substances, chlorophyllic acid and phyllochromogen. The latter arises from chlorophyll through decomposition, and is probably what gives the various colouring matter of flowers by oxidation.

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